MODERN
Machine Shop
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A Magazine for Machine Shop Executives
HOWARD CAMPBELL, Editor

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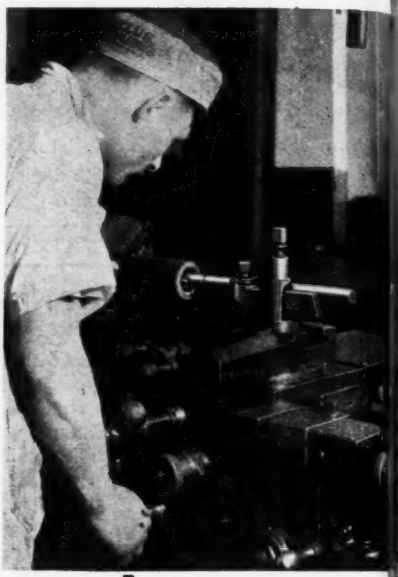

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MODERN Machine Shop

APRIL, 1930

CINCINNATI, OHIO VOL. 2, NO. 11

Modern Tooling Practice

By FRANK W. CURTIS

THE use of jigs and fixtures, commonly known as tooling, was a natural sequence to the development of interchangeable-part manufacture and high-production methods. The principal function of tooling is to provide means for economizing on manufacturing time, and thus make possible a reduction of manufacturing costs by means of interchangeable manufacture.

This article is the first of a series that will deal with the basic and fundamental principles underlying the design and construction of jigs and fixtures for the manufacture of interchangeable parts.

Upon the tooling methods used depend, to a large degree, the accuracy that is to be obtained in the production of interchangeable parts, and for this reason the science of tool engineering is recognized, today, as a very important factor in the manufacturing field. Only those who have of necessity been required to solve intricate tooling problems realize the importance of the science and have learned that this specialized branch of mechanical engineering may really be considered the foundation upon which is built modern manufacturing practice. Strict interchangeability of parts is not often obtained, as there is usually a certain amount of fitting to be done during the process of assembling. By the use of carefully designed tools and equipment, however, the cost of such fitting can be reduced to a minimum.

Advantages of interchangeable manufacture tools that are used in the machine are of the greatest importance. By means of such tools, unskilled workmen can easily perform operations on which the tolerances are close. Without the advantages of modern tooling, many of the products now on the market at reasonable prices would be so high in cost that their purchase would be in the nature of a luxury. The automobile, for example, could only be purchased by people of wealth if it were necessary to lay out and machine each part of the mechanism separately. Many other articles of commerce would come in the same classification, consequently the world owes a great deal to the engineers who have specialized in the develop-

ment of modern tools for high production, because of the great advantages which accrue to the public from the production of reasonably priced goods.

There are three basic duties to which jigs and fixtures contribute.

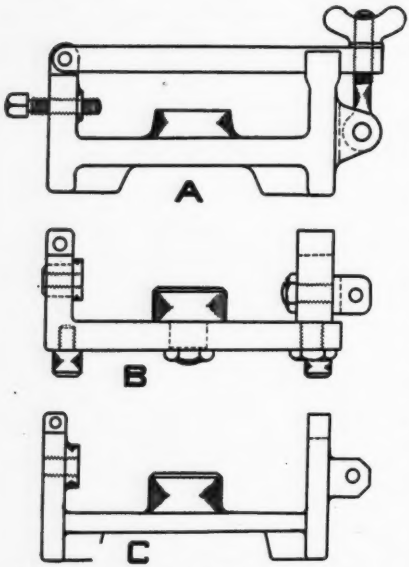

Fig. 1—Examples of Cast, Built-Up and Welded Tool Construction.

These are: (1) to hold the work in correct relation to the cutter, (2) to guide the tools so that the operation will be performed within prescribed limits, and (3) to make possible a maximum of speed with a minimum of labor cost and thus reduce manufacturing costs. Quantity output is the factor that determines whether or not jigs and fixtures can be employed on a paying basis, and the quality of production required determines, to some extent, the type and style of tool to use. Hence, an economic analysis should be made of the requirements of the job and the possibilities of jig or fixture design, just as is done in most plants when a new machine tool is to be considered. The result of the investigation will aid in selecting the class of tool to design for a given operation. It is difficult to make an absolutely definite statement regarding the method of production for a given piece of work unless the tool designer has a clear understanding of the functions of the part.

Before designing a tool, the cost should be estimated, then the designer should figure how long it will take that tool to pay for itself at a given rate of production for a given number of pieces, based on a unit saving in direct labor. If the production is high, the calculation can be made to show the direct profit to be earned over a stipulated period of time. On the other hand, it may be estimated that a tool will save a certain amount per piece, so that the problem would be to determine how much can economically be spent and how many pieces must be made to make the application economic.

These points are discussed first because, after all, they bear a direct relation to tool design, and it is well to study any problem from the beginning when expense is concerned. Money can be wasted in tooling just as easily as in any other form of false economy. One point to consider in tool design is that the machine tool is no better than the tooling used with it. A high-grade, precision machine will lose its advantage if the tooling is of weak or poor design.

Types of Tools

From the standpoint of design there are three types of tools. These are shown in Fig. 1. The tool shown at **A** is of cast construction, the body being made either of cast iron or cast aluminum. Cast iron is usually preferred, although in cases where the

tool is of unusual size and must be handled frequently, it is made of aluminum. The second type, shown at **B**, is known as the built-up type, pieces of flat and round steel being used to build the jig to the desired shape and size. The third type, shown at **C**, is of welded construction and is probably the latest contribution to modern tooling practice.

Castings for Jig and Fixture Bodies

In laying out a tool, it must be remembered that strength and rigidity are of utmost importance. Round corners are always preferable, and generous fillets should be used on angular designs, wherever possible. The designer may unthinkingly lay out a section with square corners as shown at **A** in Fig. 2, whereas the nature of the casting would permit a design embodying generous fillets, as shown at **B**. The chief objection to sharp corners is the possibility of cracks developing from the inner surface as shown at **C**. At **D** and **E** are shown two designs of angle plates, one embodying sharp corners, and the other made with round edges and fillets. It may be somewhat cheaper to make a pattern with sharp corners, but round corners would not add much to the expense of the pattern and the added strength is worth the cost. Round corners not only look better, but they are safer, as injuries may easily result from handling tools made with sharp corners.

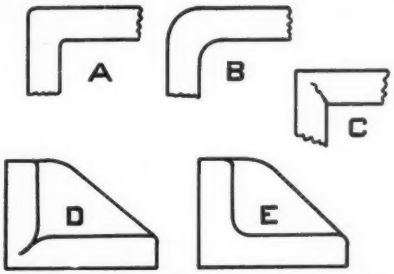

Fig. 2—Examples of Square and Round Corners.

Welded Tooling

Tools of welded construction have a rather wide field. As in any other type of equipment, however, there are limiting factors, consisting principally of intricate or complicated design and unusual size. However, welded construction has been used to a considerable extent in the past two years and the advances have been quite rapid.

Generally speaking, the advantages of welded tooling are rather broad. No patterns or castings are required; the time required to construct a tool is usually reduced; a design embodying less weight is made possible; the construction is somewhat stronger; as a rule less machining is required to complete a welded fixture; miscellaneous short and otherwise obsolete pieces of flat and round steel can be utilized; and the upkeep is less. Welded tools require the following operations for completion: layout of the design wanted and then a layout of the various parts needed in construction; and acetylene cutting operation to shape the parts specified; a fitting operation, which includes assembly by tack welding the pieces together in their relative positions; arc welding, which includes the joining together of the various component parts. There is a likelihood of setting up certain strains during welding, therefore, it is advisable to anneal the welded unit before machining, and furthermore it is suggested that the unit be given a thorough sand blast, followed by a coat of paint. In this condition the unit is ready for machining, and if made correctly will form a rather pleasing construction.

In Fig. 3 is shown a variety of joints made by the welded process.

At **A** is a T-joint often used where ribs and intermediate sections are required. At **B, C,** and **D** are shown three representative types of right-angle joints. At **E** is shown a built-up construction, in which a square section is inserted into a rib. At **F** is shown the method of joining a large, round or square pad on to a flat section. Corners of a built-up jig or fixture body can be strengthened by welding a section in as shown at **G**. At **H** is shown a construction involving miscellaneous joints. The design shown at **J** represents the application of two bosses to accommodate an eye bolt or a hinged unit, and at **K** and **L** are shown two methods of constructing bosses for bushings, screws, pins, or spring jacks.

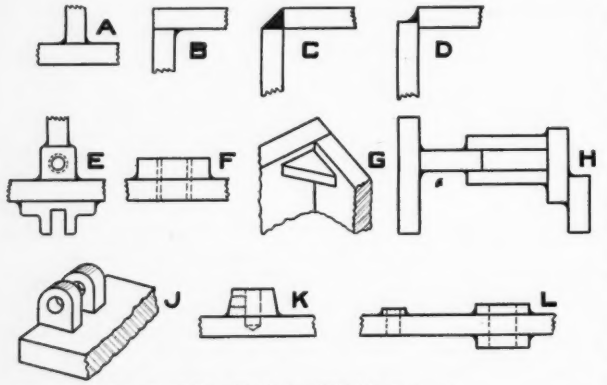

Fig. 3—Joints Made by Welded Process

A jig body in which some of these points are used is shown in Fig. 4. Although no general proportion has been adopted for the size of the fillet required, past experience has shown the following to be satisfactory: When the thickness of the plate is ¼-in. to ⅜-in. the fillet should be from $\frac{3}{16}$-in. to ¼-in.; plates up to ½-in. require fillets from ¼-in. to ⅜-in., and plates up to ¾-in. should have fillets ranging from ⅜ to ⅜-inch.

In laying out tooling for a part it is always well to prepare a comprehensive operation sheet on which are listed the operations to be performed and the tooling required. The first move in laying out the operations is to determine suitable locating points which can be used for all subsequent operations. Referring to Fig. 5, at the left is shown a cast-iron cover requiring various milling, drilling, and tapping operations. Inasmuch as all the holes must be in relation to one another, as drilled from the various sides, it is necessary to machine the top surface **A** as the first operation and then drill the eight flange holes as a second operation. It may be quite possible that the limits of these flange holes are such that they would not be satisfactory for locating purposes, in which case it is advisable to ream two of the holes for this purpose. The locating points should be set as far apart from each other as possible, and in this example the two holes **B** should be used. With the flat surface and the two locating noles, it is possible to machine this part accurately on an interchangeable basis.

The locating pins to be used in connection with the holes **B** should be hardened and ground. In cases where two locating holes are required, it is often necessary to provide clearance between the holes and the locating plug, the common method being to use round plugs such as those shown

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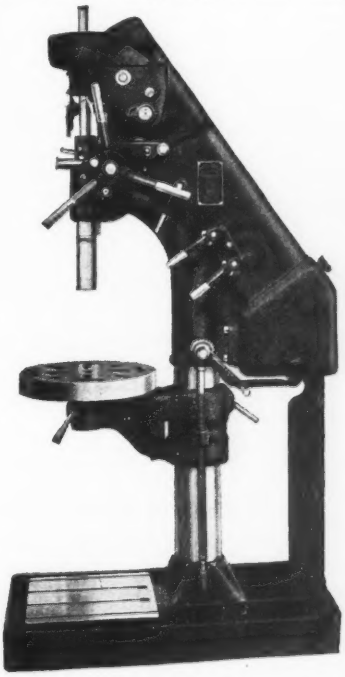

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at **C**. When the limits are close, however, there will be some difficulty in locating and ejecting work, therefore it is advisable to relieve one of the locating pins, as shown at **D**. In some cases it will be found satisfactory to flatten both locating pins, although the locating surfaces should be at right angles to one another as shown at **E**. Another advantage can be gained in locating this class of work by having one locating pin somewhat higher than the other, so that the work can be located with greater ease.

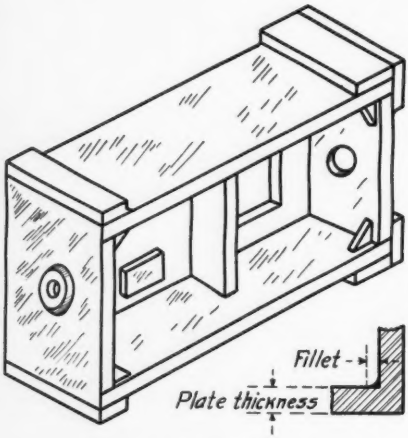

Fig. 4—Jig Body With Welded Joints

Accuracy of Work to Be Produced

The design of production tools is affected in a marked degree by the accuracy required. In order that a certain mechanism may function correctly, the various parts used must be machined in certain relations to each other, thus maintaining the proper limits within which the pieces can be manufactured. The designer who has developed the product usually determines the accuracy required and the tolerances permissible. These are specified on the detail drawings of the parts. The design of tools to be worked out is therefore dependent to some extent on the tolerances specified. For example, if a casting has two holes to be drilled and reamed and a center distance between the holes is to be maintained within a limit of plus or minus 0.0005 in., and if the tolerance in the holes themselves are about the same, the design of the jig would involve most careful work in order that the tolerances specified would not be exceeded. The work would need to be located on hardened and ground plates or suitable surfaces, and provision would have to be made for replacements of parts when worn. The body of the jig would probably be of cast iron, properly ribbed and strengthened to prevent any spring or distortion. All bushings would be hardened, ground and lapped, and of suitable length so that the drill or reamer would be held in alignment in order to obviate errors. The cost of construction of a jig of this sort would be comparatively high, but the accuracy of the product would warrant the expenditure.

In designing a jig for a piece of work having tolerances of plus or minus 0.005 in., much simpler construction could be used. The work would not require such careful fitting, consequently the cost would be materially lower than in the other instance. Furthermore, there would be fewer refinements in the jig because of the greater latitude permitted in machining.

Production Required

The design of tools is affected by the production required in a number of ways. It may be considered that there are two types of tools in common use, one of these types being used for high production and the other for low production. A high-production

(*Continued on page 20*)

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FEED and SPEED CHANGES FROM FRONT OR REAR.

WITH the introduction of this new and simplified method for changing speeds and feeds *by power* from the front or *rear*—operating convenience takes on a new meaning. On the new No. 3 Cincinnati Millers you instantly obtain with ease the right speed or feed without moving from the *normal* operating position either at the front or *rear*. It is so easy that your operator keeps your machine in high at all times. He does the job in less time and obtains a higher quality of milled surface.

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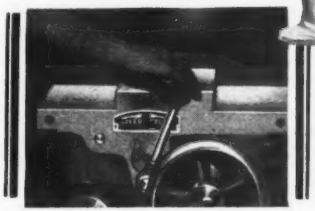


Close up of the speed and feed change lever located at the front of the knee.

Modern Tooling Practice

(Continued from page 16)

tool should have wearing surfaces of the best quality and provisions should be made for long life and replacement. Conversely, a low-production tool does not require provision to be made for replacements and the work can often be located directly on a finished surface machined directly on

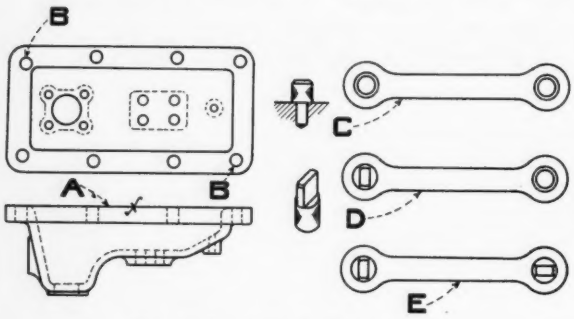


Fig. 5—Types of Locating Pins

the body of the jig. Again, in low production tooling, a piece may be set into a jig or fixture and several operations completed at one setting. The jig may be moved from one machine to another and turned on various sides, and although the time required for performing the various operations in this way would be greater than by using separate tools for each individual operation, the cost of construction would be much less and a saving would therefore result.

It will be seen from the foregoing that the production required determines to a great extent the method of handling the work. In low-production fixtures, simple designs will answer the purpose and efforts should be made to cheapen the construction as far as is consistent with the nature of the work. On the other hand, in high-production tools rapid clamping facilities and other refinements are usually employed. In either case the cost of tools is distributed over the amount of production required, so that the cost per piece would not be excessive.

Laying Out Methods of Operation

In laying out operations for a given piece of work, all of the points previously mentioned must be carefully considered, together with other factors of importance. The machines available for manufacture govern the method of handling to a certain extent and in layout operations the engineer must keep these points in mind. In certain cases, suitable machines may not be available and it may be necessary to adapt those which are on hand.

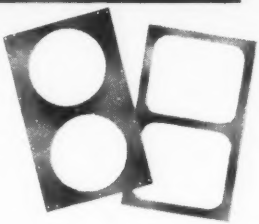
Under such circumstances the selection of working points must be made carefully and if possible the work should be carried through the various operations by using the same location in order to minimize errors. Occasionally it is necessary to add another lug or boss or to machine another hole in order to assist in the machining operations. The product may have been designed by an engineer who was not thoroughly familiar with tooling methods, with the result that the manufacturing cost would be excessive. It is therefore advisable to analyze the product before laying out the tooling, and consider carefully any changes in design which might improve the method of production without interfering with the functioning of the product.

"Paid for itself... *in one year!*"

says Mr. William Renick,
Superintendent of Webber & Wells, Inc.,
Chicago, Illinois

At the right are illustrated two interchangeable steam table panels, the center openings of which are cut out with a Model 1-B Campbell Nibbling Machine.

Stainless steel alloys and Monel Metal are the materials used for these parts.



"MY Campbell Nibbling Machine is busy all of the time, and I don't know how I ever got along without it," Mr. Renick states.

"The cost of labor for cutting the openings in steam table panels is reduced fully 35%. There is no distortion of the metal, and it takes very little grinding to make a beautiful job."

This is typical of reports from Campbell Nibbling Machine owners in many different types of industries. Campbell Nibbling Machines are made in various sizes to handle stock up to 3/8". They can be adapted to many special uses for production work, saving thousands of dollars in labor or special dies. Submit your problems to us.

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Tool Drawings

At this time it may be well to mention a few points concerning tool drawings. Many shop executives do not realize the advantages of working drawings for shop use and as a result do not benefit by the many savings that a tool drawing offers. Regardless of what size your shop may be, it is far more profitable to have drawings made of all tools and fixtures than it is to have none.

The advantages may all be considered as economic saving. A tool drawing will permit the proper development of a satisfactory tool and will reduce the cost of tool building. Tool drawings permit correct proportions to be attained and are often responsible for avoiding interferences that otherwise might not be detected. Tool drawings serve as records for further use and create a saving in making repair parts.

Tools can be made without drawings, but where such practice prevails, the tools usually lack full efficiency and the cost is extremely high due to the use of the "cut and try" method. On the other hand, if a complete drawing is made beforehand, the tool can be built without delay and without question as to what is wanted. Some of the points that are often overlooked when tools are built without drawings are: no chip clearance, bushings too close to the work, insufficient finger clearance around knobs and handles, lack of rigidity and strength; no provisions for wear, and slow clamping methods.

In brief, tooling for interchangeable manufacture requires a knowledge of the handling of machine tools, both from the theoretical and from the practical end, and a thorough knowledge of cutting tools as well as the relative speeds and feeds that can be used for a given piece of work.

Using Tungsten-Carbide Tools

If you are using tungsten-carbide cutting tools on any of your machining operations, be sure your machines are well lubricated. The one thing that is absolutely fatal to tungsten-carbide tools is vibration. Everyone knows that while the tungsten-carbide tip on these tools is very, very hard, it is also brittle and will crack easily if subjected to the intermittent shock caused by vibration anywhere in the machine. In fact the rapid succession of shocks caused by vibration will break these tools more readily than will the less frequent shocks caused by intermittent cuts.

There is no worse vibration in a machine than that caused by a loose bearing. A loose bearing allows the work to chatter, producing a rough finish on the work, excessive wear on the tools, and in the case of tungsten-carbide tools it is almost sure to produce failure.

The manufacturers of these tools report that over 30 per cent of the cases in which their tools have broken in service can be directly traced to loose bearings. These failures, of course, can be obviated by keeping the bearings in proper adjustment and keeping them well lubricated with a high grade lubricant. Anti-friction bearings have been found far superior to plain bearings on machines where tungsten-carbide tools are to be used. Due to the high speeds and heavy tool pressure, anti-friction bearings will run much longer without adjustment and assure smoother operation.

But, regardless of the types of bearings used, be sure they are well lubricated, and kept in adjustment.

—"Houghton's Black and White"

AVIATION
Takes No Chances!

IN aircraft engines endurance and dependability are of first importance. The safety of passengers and pilots depends on their performance . . . So, leading aircraft motor builders take no chances with small tool equipment. They use BATH GROUND TAPS and THREAD GAGES to control tapped hole sizes . . . The pictures show a tapping operation on an aluminum cylinder head of a popular make of engine, a 5″ adjustable tap of BATH design also for aluminum cylinders, and a double end go and no go thread plug gage of the American Gage Design.

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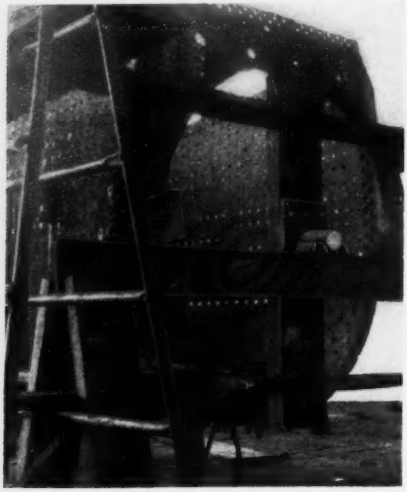
Special Tools for Back Shop Work

By C. C. JOSEPH

THE work of installing new crown sheets and overhauling the firebox end of locomotives in the Denver shops of the Denver & Rio Grande Western Railway is greatly facilitated by the use of special jigs, shown in the illustrations. With these jigs an entire section of a boiler can be swung some three feet off the floor, so that the old rivets and staybolts can be cut off and backed out with air tools, and new ones put in.

Each jig consists of a pair of steel horses and two spindles, one of which is attached to a section of 14-in. channel and the other to a square section of 1-in. plate. The horses are of 10-in. channels, the sections used for legs being cross-braced at the top and bottom by ½-in. steel plate, well riveted for safety. The section of channel to which one of the spindles is attached is placed across the open end of the boiler, to which it is attached by bolts through sections of angle plate that are anchored to the channel at either end, as shown in the illustration. Sections of boiler plate, shaped to form a "V" and bolted to the top rail of the horse, locate the spindle and prevent it from moving out of place.



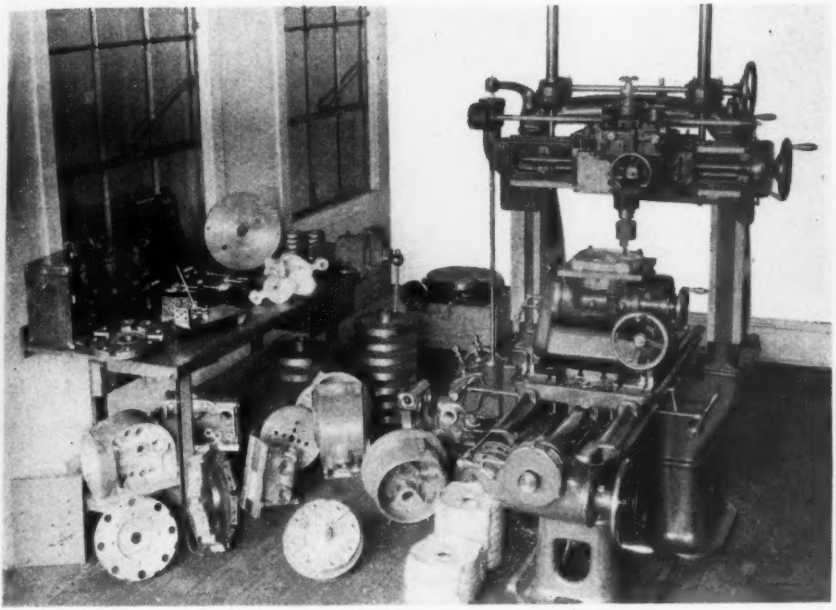
Jig Supporting Open End of Firebox

Using a Thor air-jam underneath the boiler

These jigs make it possible for a couple of men, with the aid of an overhead crane, to turn the shell to any angle required by the work to be done. As a matter of fact, the jigs raise the firebox high enough from the floor so that most of the work required may be done without turning it, as practically the entire outer surface is easily accessible to the "rivet buster."

In bucking the ends of rivets and

At Kingsbury Machine Tool Co. *they do jobs like these on the* **SWISS JIG BORER** *to limits of 0.0005" and in half the former time.*



You ought to have, if you are interested in tool making, our new catalog 546 describing the four larger sizes of the Locating and Jig Boring machines. They will save you money, and do your work more quickly and more accurately.

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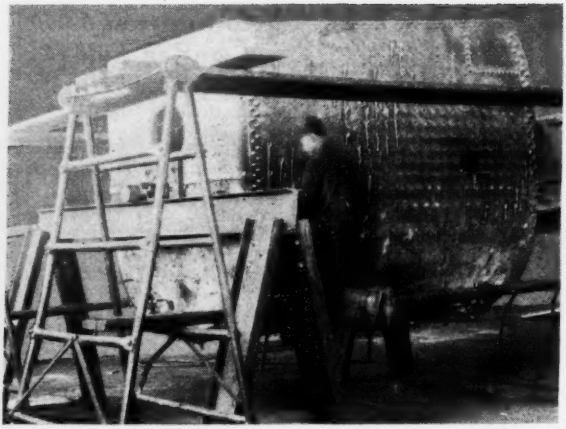
MILWAUKEE.....Neff, Kohlbusch & Bissell
610 Michigan Street

SAN FRANCISCO.....Joseph C. Fletcher
661 Folsom Street

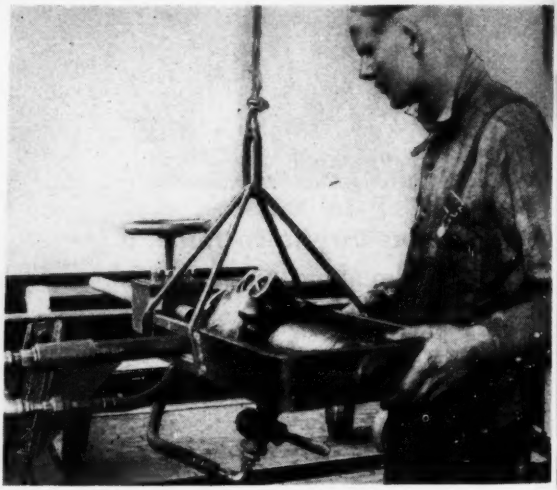


Front End of Firebox, With Support In Place

staybolts, a 14-in. air "jam," made by the Independent Pneumatic Tool Company, is used. The piston of this tool has a range of approximately 7 inches, and by using various lengths of iron pipe and wood blocking, the workman is enabled to adjust his jam to any height required.

The ends of superheater tubes are reamed out by the use of a Thor air drill that is held in a specially-constructed sling and suspended from an overhead track by a ½-in. wire cable. The main frame of the sling is of ½ x 3-in. iron, shaped to the form of a rectangle and welded. In each side of this rectangle is a 1½ x 9-in. slot for the handles of the drill, and at the rear end a hole is tapped out for the rear end of an 8-in. air jam which is used to hold the drill to the work. The drill is operated by the usual air connection to the handle, a branch connection from the same air line leading to the air jam from underneath. Two lengths of ½-in. rod, welded to the frame at either side and brought together above, provide means for attaching the frame to the cable, as shown.

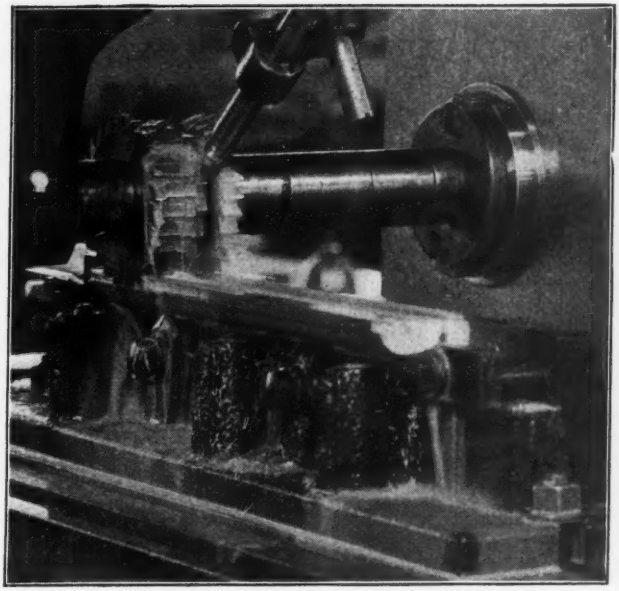
At the front end of frame is a jig in which the work is held for reaming. The jig is made of two metal blocks, hollowed to fit the radius of the tubes and boxed in with a frame made of ½-in. plate, 5½ x 5½ x 4½ in.,



Reaming the ends of superheater tubes with a Thor drill and special jig

welded at the junctions. The bottom of the jig is a block of 2 x 3 x 5½-in. steel, which is also bolted to the under side of the frame. The top, which is a block of 1½x3x5½-in. steel, is held by four set screws

(Continued on page 114)



You Get MORE Than Transparency with HOCUT

Machinists know that the transparent solution of Hocut metal cutting coolant leaves the work and tool clearly visible—insuring greater accuracy and finer finish.

But that is not all! Transparency of the Hocut solution results from almost complete solution in water of the refrigerating oils, etc. In consequence, Hocut has better "wetting out" and refrigerating properties than ordinary soluble cutting oils which form a milky emulsion.

Greater cutting speeds and feeds are possible. Tool grinding is less frequent and production is increased.

HOCUT is a Product of *The* ***HOUGHTON LINE***

E. F. HOUGHTON & Co.

Philadelphia, Pa. *And All Over the World*

Keeping Production On Schedule

By WALDO HUTCHINSON

NO plant, however small, can afford to neglect giving at least some close attention to "follow-up" methods, because without accurate information as to delivery dates and progress of work, a sales organization cannot give the exacting service demanded by customers in these days of keen competition and close prices. The following outline comprises a synopsis of a simple plan, which can be operated at small expense, for handling this problem.

After a comprehensive study of manufacturing and sales conditions in a number of plants, it was found that in order to achieve the co-ordination desired, a system was required whereby orders for production, which were made out by an order clerk in the office, could be distributed to the shop in a systematic manner and as systematically followed from start of production until the goods were packed and shipped. The system as finally worked out provided for the following essentials:

1. The proper route of orders for goods manufactured and the correct planning of schedules of production.

2. The determination, as accurately as possible, of delivery dates and the keeping of information as to orders constantly before the sales manager.

3. The securing of all materials necessary to complete a given job and the elimination as far as possible of all extra moves in securing stock.

4. After the determination of delivery date, the constant following up of jobs from start of work to completion and shipping, and the reporting immediately of delays in progress of jobs to the sales manager.

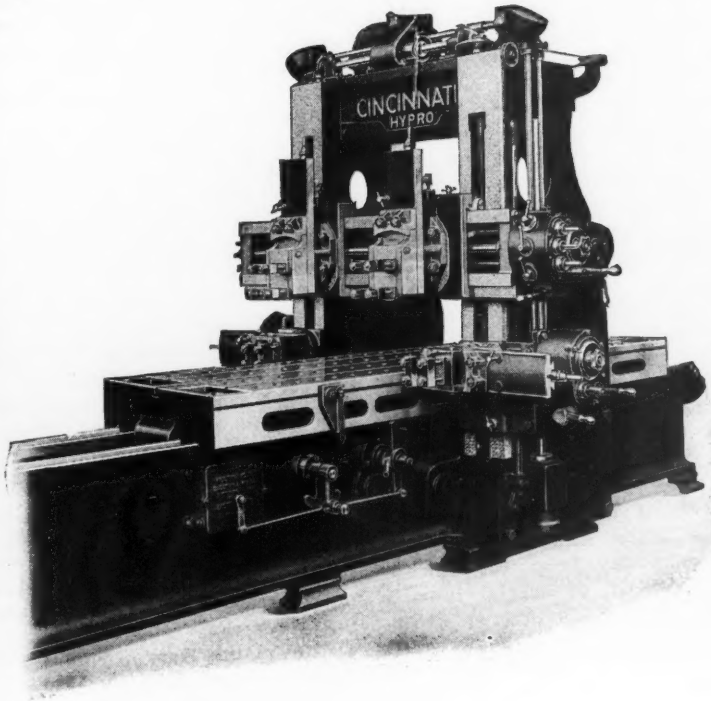
5. The interlocking of production and cost records.

6. The knowledge at all times of the progress of all jobs in the shop, so that shop and office executives are kept posted as to the existing production conditions.

In one plant, one man devotes his whole time to the work of equipment and personnel. He is a big-caliber man—capable of winning the confidence of shop foremen and of helping and instructing them in planning production in their various departments. He has a wide knowledge of costs and methods of establishing operation lists and piece-work rates and tabulating these in such form as to be easily understood when sent to the cost department for incorporation into the cost records. He is assisted by a competent stenographer who also has ability as a general clerk. It was found advisable to hire a new clerk and instruct her in her duties rather than to use a clerk familiar with old methods and routine. A girl does this work as easily as a man and some detail phases of it perhaps better.

The production man has an office centrally located in the plant where the foremen readily seek him out if necessary, for consultation, although in most cases the production man is called on the telephone and goes to the foreman, thus making it possible

CINCINNATI HYPRO-PLANER



Selective Dial Feed, Instantaneous Rail Lift, Rail Clamp, Rapid Traverse and Forced Lubrication are a few of the Leading Features.

THE CINCINNATI PLANER CO.

3120 SOUTH STREET CINCINNATI, OHIO

for the foreman to remain in his department. Furthermore, the majority of problems the production man has to deal with are, of necessity, settled in the department and very frequently directly at the job where the question first arises. The office equipment consists of desks for the production manager and clerk, simple filing cabinets, a typewriter, and a telephone with connections to all parts of the shop. All production orders are issued by the order clerk in the office upon notification from the proper executives that goods are needed, and are sent direct to the production office in the shop. These orders are in triplicate and the three forms are made up as shown in the illustrations.

As shown, the first copy is marked "Foreman's Copy," the second "Production Memorandum," and the third, "File." The paper used is of substantial quality, to stand handling. A desk letter basket, labeled "Incoming Orders," is placed on the production man's desk, and all orders are deposited in it when received from the office. These orders are sent once a day from the office—oftener in cases of special importance where quick action is necessary.

Upon receipt of orders from the office, the foreman's copy is signed by the production man and taken to the foreman in charge of that particular branch of the work. The production man at this time arranges with the foreman for the securing of stock. He goes to other foremen if necessary to obtain component parts. He also sets the delivery date of all goods named in the order.

Upon the return of the production man to his office, he dockets the above information on the production-memorandum copy of the order, and places it on file under the date for that day.

The file copy has the information required for reference entered on it and copy filed by numerical order in another file as a cross-reference.

Production memoranda is filed in a cabinet having 31 divisions numbered from 1 to 31, which allows a division for each day of the month. When the information is secured regarding delivery date, the production man files this memorandum under the date which he deems it will be necessary to follow up progress on goods called for. The date is usually some time in advance of the scheduled shipping date, because it is necessary for him to know progress and of any impending failure before delivery date, if at all possible.

This he repeats on each order and as many times for an individual order as is necessary to follow the order to completion. By this means an automatic "follow-up" is provided of jobs in process.

When an article is finally shipped, the production memorandum is removed from the file and placed in an index arranged alphabetically according to various goods manufactured by the plant, thus providing another cross-index of shop orders.

Now comes the question, "How are executives advised of production conditions?" After the delivery date has been set the production man fills out the form "Report A" and forwards it to the sales manager or any other executives designated. When the production schedule runs behind and the delivery date set cannot be met, "Report B" is filled out and sent to the same officials who received the first notice, or "Report A."

When the goods are finally shipped

Simple—rapid—economical—*that tells the whole story!*

HORIZONTAL DISC GRINDING *IS* ECONOMICAL ON HUNDREDS OF JOBS!

THE operation shown here—grinding diaphragm covers for gas regulators on a Gardner No. 24-53" Horizontal Disc Grinder—is indeed simple, rapid, and highly economical.

It is purely a hand operation—no expensive fixturing, nor loss of time through fixturing—just a simple hand lever used to apply pressure during grinding. This arrangement is handier than piling on weights, and insures a much quicker grind than if operator merely applied pressure free-hand.

These covers are 19" in diameter, and approximately 1/16" stock is removed from a ribbon of metal 3/4" wide. They are cleaned up flat to a gasket joint, AT THE RATE OF 35 PIECES PER HOUR.

GARDNER DISC GRINDERS— Up-to-Date Flat Surface Finishing Tools!

Find Out What This Tool Can Do In YOUR Case—
WRITE FOR BULLETIN NO. 241

GARDNER MACHINE COMPANY
Specialists in Grinding Equipment
428 East Gardner Street Beloit, Wisconsin, U. S. A.

the form illustrated as "Report C" is forwarded by the production man to the officials who received Reports A and B, thus completing the cycle of information necessary to enable a sales manager to keep his customers fully informed as to the progress and reliability of delivery as scheduled on their respective orders.

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On all costs figured or estimates of costs made by the cost department, a copy is sent to the production man, who checks and approves them. He then returns the cost sheet to the cost department, after which the cost of the job or the operation is incorporated with the permanent records of that department.

At the start of the system, and from time to time as necessary, the production man co-operates with the engineering department and establishes bills of material for all goods manufactured. These are made in permanent form and copies are filed in the production and cost departments, as well as in the engineering departments.

It has been found that if this is done when orders are issued for production, it is a simple matter to check the material needed for the job and it is also much easier to figure costs at the completion of the work, as there is a definite list of material to check against waste and spoilage as well as production.

The plan here given is a bare outline or skeleton for follow-up work. The various minor details have purposely been omitted. They can be designed to meet the necessities of each individual plant, and they should form a part of the general outline of work when the system is installed. It has been found that with a production man in charge, there is no excuse for various clerks, foremen, or salesmen running about the plant issuing conflicting orders, thus neglecting their own work and hampering production work in the shop.

While the production man's function is to keep all department heads interested and posted as to progress of work, he follows a general outline, laid out by the one man who has entire supervision of the plant. He is responsible to him only, and any criticisms directed at the production department goes direct to the official to whom the production man is held responsible.

At the start of this system, all foremen receive notice to the effect that a new system is being inaugurated and that their co-operation is requested. Foremen are made to thoroughly understand that the production man's function is not to direct actual production, as that duty or right belongs to the foremen

CLAMPS THAT HOLD

For light, general, or heavy service, there's a Williams' Clamp that will hold rigidly—without springing.

Drop-forged from tough special steel and heat-treated for extra stiffness. Built for long service and hard use in a wide range of styles and patterns.

J. H. WILLIAMS & CO.
"The Drop-Forging People"
New York BUFFALO Chicago

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
DROP-FORGED
CLAMPS

FOREMAN'S COPY

Date..... Order No.....

Item ....

Route .....

To Be Completed.....

.....

Production Manager

PRODUCTION MEMO.

Date..... Order No.....

Item.....

Route.....

Should Start..... ..Should Finish.....

Cost Checked..... By.....

Comments

FILE

Date..... Order No.....

Progress

Item.....

Route.....

Stock.....

Will Start.....

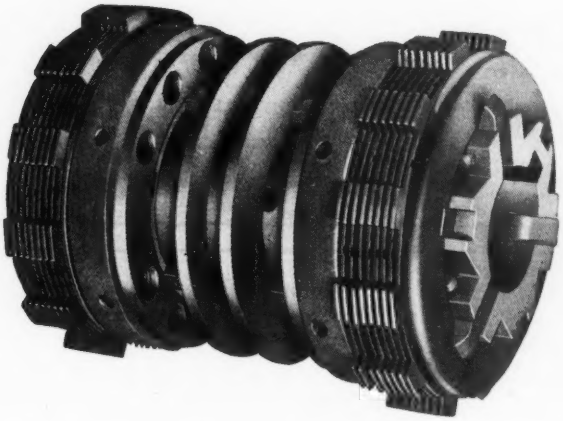
To Be Completed.....

Report "A" Made.....

THESE TRIPLICATE FORMS ARE PRODUCTION ORDERS. The foreman gets a copy bearing the production manager's signature. The production memorandum copy is filled in with full details and goes into the production manager's tickler file. The file copy is a cross-reference copy and is filed numerically.

themselves, but he is to keep them posted as to what is expected from each department, see that raw material is ordered by the purchasing department for goods to be manufactured, see that the materials arrive on time or are kept in sufficient quantities to keep jobs running smoothly and regularly, and see that each job is completed, inspected, and passed to the shipping room on schedule time.

Shop men are particularly notified not to accept any verbal orders, nor written orders unless they are signed by the production man or his super-



Now a Complete Line

BY the time you read this, the full line of Twin Disc C. C. machine tool clutches will be in production, and we shall be able to fill your orders for clutches with effective diameters as follows:

2", 2½", 3", 3½", 4", 4½",
5", 5½", 6", 7" and 9"

C. C. clutches are available both in dry plate type, with compressed asbestos drive plates—and in oil sprayed clutches, with alternate bronze and steel plates. The same compact design is used in both types, with the entire operating mechanism in the hub. Write for engineering data.

TWIN DISC CLUTCH COMPANY

RACINE WISCONSIN

SALES OFFICES

CLEVELAND, OHIO	NEW YORK CITY	TULSA, OKLA.
908 Smythe Bldg.	Room 1553, 101 Park Ave.	1645 East 16th St.
Mr. R. H. Smith	Mr. W. L. Dixon	Mr. R. R. Sloan

REPORT A

DELIVERY

Shop Order No.....Dated.....

For .....

Complete Delivery May Be Expected

.....Production Manager

If No Other Report Follows, Delivery Is On Time

REPORT B

DELAYED

Shop Order No.....Dated.....

For .....

Promised Delivery Date Was.....But Owing To

.....

Delivery Cannot Be Made Before.....

.....Production Manager

REPORT C

COMPLETED

Shop Order No.....Dated.....

For .....

Completed Today .....

Comments .....

.....Production Manager

HOW THE EXECUTIVES ARE ADVISED. When delivery date has been set the sales manager gets a promise on the top form. A delay is reported on the middle form and completion is recorded on Report C.

iors. This eliminates all chances of work being ordered and no records of costs being kept for it.

A system has been devised by the sales department so that it keeps notices from the production office on file with reference to correspondence from customers and orders for goods. With the close co-operation of the sales force and the shop production department, a general betterment of shop and office conditions has been noticed as a result.

Furthermore, the rendering of accurate information regarding progress of manufactured goods to the sales organization enables it to keep the customers satisfied and thus build up an enviable reputation for prompt delivery of goods on specified time.

AND FEEDS . . . . LOWER PRODUCTION COSTS

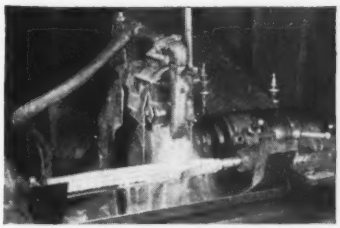
The care with which Sunoco is refined has much to do with its supremacy. So far as we know, no other lubricant offers all these advantages:

Increased cutting speed.
Increased quantity of metal removed per tool grind.
Unusual cooling and lubricating properties.
The increased quantity of water that can be added for a given kind of work.
The time the mixture can be used before replenishing.
Prevents rust and corrosion.
Protects operators from skin infection.

Sun Oil Company engineers will be glad to work with you in obtaining greater efficiency in the application of cutting lubricants. An engineer will call at your request.

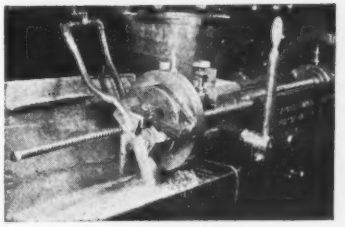
Tune In THE SUNOCO SHOW!
EVERY Tuesday Evening, 9.30 Eastern time, 8.30 Central Time —WJZ and Associated Stations.

OPERATION: GRINDING TAPER ON MAIN SHAFT
MACHINE: NO. 11 BROWN & SHARPE
MATERIAL: 5% NICKEL
WHEEL SPEED: 1900 R.P.M.
WHEEL DIAMETER: 14 INCHES
PRODUCTION: 40 PIECES PER HOUR
LUBRICANT: 1 PART SUNOCO TO 40 PARTS WATER

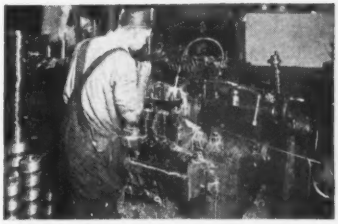


Courtesy of Autocar Co., Ardmore, Pa.

OPERATION: BROACHING ENGINE SUPPORT CLEVIS.
MACHINE: LAPOINTE MACHINE TOOL CO.
MATERIAL: DROP-FORGED STEEL
TOLERANCE: 1.236—1.2375
FEED: 108 IN. PER MINUTE
LUBRICANT: 1 PART SUNOCO TO 5 PARTS WATER



Courtesy of Autocar Co., Ardmore, Pa.



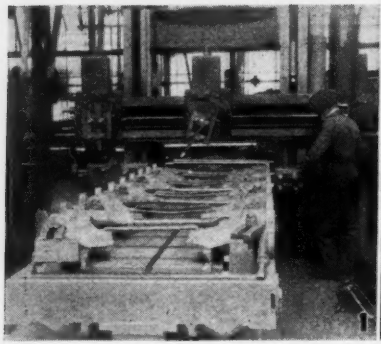
Courtesy of Foote Bros. Gear & Machine Co., Chicago, Ill.

OPERATION: FINISH. TURNING OUT SIDE DIAMETER, FACE AND HUBS ON A SPLINED ARBOR.
MACHINE: FAY AUTOMATIC 19 IN. LATHE
MATERIAL: 2320 NICKEL STEEL.
SPEED: 120 R.P.M.
LUBRICANT: 1 PART SUNOCO TO 12 PARTS WATER

SUN OIL COMPANY, Ltd., Montreal

SUNOCO
CUTTING OIL
of BLUE SUNOCO MOTOR FUEL

JACKSON, MICH · JACKSONVILLE · MIAMI · MONTREAL · NEWARK · NEW YORK · PHILADELPHIA · PITTSBURGH · PROVIDENCE · QUINCY · READING · ROCHESTER · SYRACUSE · TAMPA · TOLEDO · TORONTO · TRENTON · TULSA · WILMINGTON



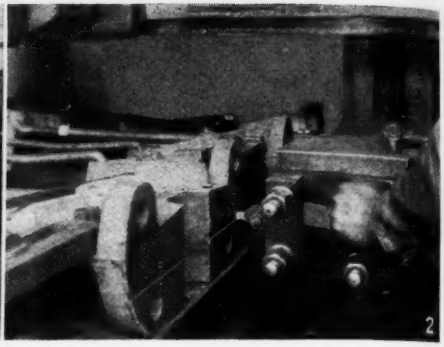


Fig. 1—Machining spider sections for Dorr "thickeners." Fig. 2—While the cross rail tool is facing the top surface, the side-arm tool is cutting a keyway in the end.

Machine Shop Operations at the General Iron Works

By Jos. C. Coyle

ONE of the three firms co-operating to operate the plant known as the General Iron Works, Denver, is the Dorr Company, which manufactures equipment for use in many industries. First developed to meet special needs in the fields of mining and metallurgy, Dorr equipment has been adapted to use in many other fields. Dorr thickeners, classifiers, and other machines are used wherever pulp, sludge, slurry, mud, or other matter that consists of solids suspended in liquids is handled in quantities. A number of the operations in the manufacture of Dorr equipment are of more than passing interest.

All castings for Dorr thickeners and classifiers are made in the foundry at the General Iron Works, which was described and illustrated on page 42, October, 1929, issue of Modern Machine Shop. A Dorr tray-type thickener consists largely of a "spider" or central casting which carries four radial arms to which plow blades are attached. The spider is cast in two sections, each of which must be machined on the face and end. This operation is shown in process in Fig. 1, where 20 spider sections can be seen clamped to the table of a planer. The sections are arranged in two rows of 10 sections each, on opposite sides of the planer table, and are held in position by clamps and 1-in. rods. The rods are

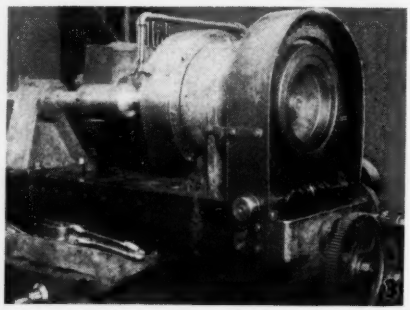


Fig. 3—Milling worms in a Cincinnati miller which has been rebuilt to adapt it for this job.

Announcing...

A NEW JIG BORER

Built and designed by Henri Hauser of Bienne, Switzerland

THIS MACHINE IS
THE LAST WORD IN ACCURACY,
WORKMANSHIP AND MATERIAL

Some of the Features:

Large micrometer drums give direct reading in .0001 for all measurements.

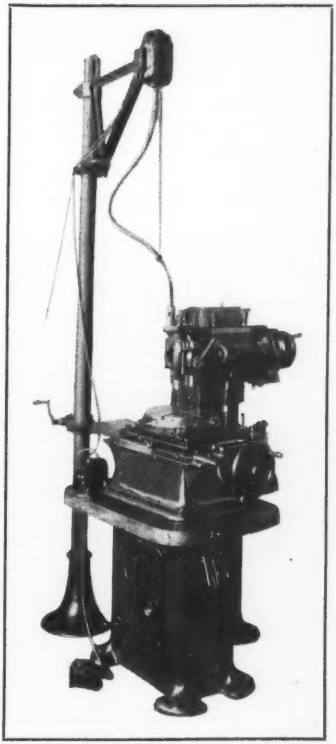
Fine worm wheel adjustment for micrometer drums makes readings of .00005 possible.

Measuring screws are fully enclosed at all times.

9½ inch vertical adjustment of cross rail gives the machine a wide range.

Sensitive counterbalances relieve both measuring screws of all strain.

Rigid construction of machine permits boring up to 1¼-inch holes in tool steel.



INDEX MACHINERY CORPORATION

49 CENTRAL AVENUE CINCINNATI, OHIO

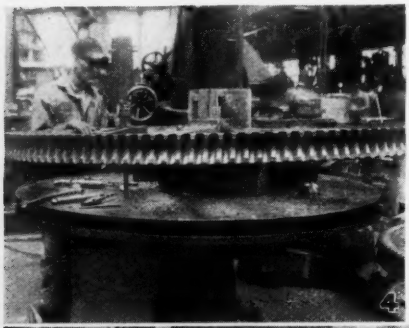
Write for Catalog

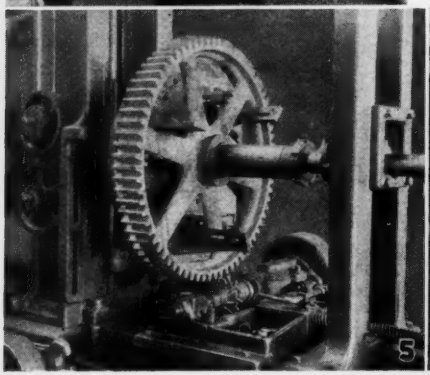
bent at right angles at each end, so that they can be inserted into the cored bolt holes in the pieces, as shown. Pipe jacks, placed at intervals, also help by applying pressure where it is needed.

The top surfaces of the pieces are faced by a tool that is held in the cross rail tool post. When this operation is in process, a side tool is used to cut a keyway in the end face of each of the castings on one side of the table, and a tongue is cut, with the other side tool, on the face of each of those on the other side. The operation is shown in Fig. 2.

The Dorr thickener is revolved by power applied through a worm and worm wheel. The worm is turned in the lathe, then it is milled in the machine shown in Fig. 3, which is a Cincinnati milling machine that has been converted into a special machine for this purpose. A bearing located on one end of the machine table carries a heavy spindle, upon one end of which is a worm wheel, the other end being threaded for a large three-jaw chuck. The worm wheel meshes with a worm that is geared to the table feed in such a way as to provide for revolving the chuck at a given rate of speed in relation to the speed of the worm. A housing attached to the front of the machine carries a short shaft upon which the milling cutter is mounted, at an angle which corresponds with the angle formed by the lead of the worm to be milled. Power is transmitted to the cutter-shaft through a train of gears which provide a positive drive in relation to the movement of the work. The shaft upon which the worm is mounted is held in a three-jaw chuck at one end and in an outboard bearing at the other, as shown.

The worm-wheels are bored and faced in a large boring mill, the teeth





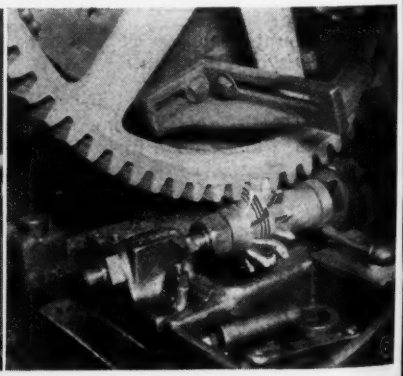
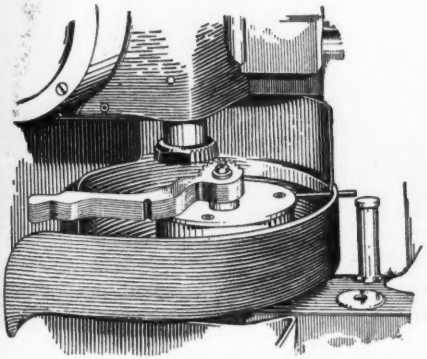


Fig. 4—Drilling and tapping setscrew holes in the hub of a worm wheel for a Dorr thickener. Fig. 5—Cutting the teeth in a gear for a Dorr classifier. Fig. 6—Two cutters are in operation simultaneously, one roughing while the other finishes.



For Those Difficult Jobs

THE Fellows Gear Shaper is not necessarily confined to the cutting of the so-called ordinary form or type of gear. It has many other possibilities, and is particularly adapted to those difficult jobs which some manufacturers think require the use of a specially designed machine.

The segment for a cash register illustrated above is a good example of the adaptability of the Gear Shaper and Gear Shaper Cutter.

Send for our book, "The Practical Art of Generating." It may be the means of solving your problems.

The Fellows Gear Shaper Co.

Head Office and Works:
78 RIVER STREET, SPRINGFIELD, VERMONT, U. S. A.

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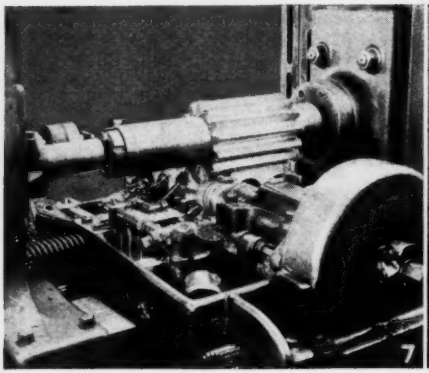

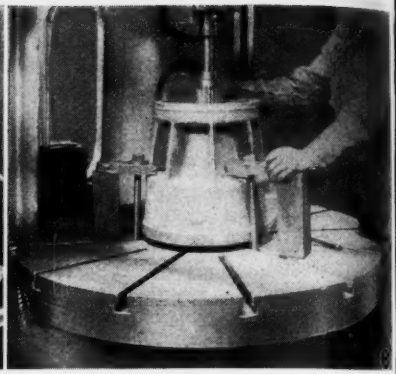

Fig. 7—Machining two pinions at a time, using roughing and finishing cutters.
Fig. 8—Reaming a valve seat in the bottom end of a diaphram pump body.

are cut in a hobbing machine, and the setscrew holes in the hub are drilled and tapped with the horizontal drilling and tapping machine shown in Fig. 4.

Figure 5 shows a gear for a Dorr classifier in process of having the teeth cut, using a gear cutting machine and two cutters, ganged together. One cutter roughs out a tooth while the other is finishing one. A close-up view of the cutters is shown in Fig. 6.

The practice of using roughing and finishing cutters together is carried out on other jobs, also, such as the operation of cutting teeth in pinions, shown in Fig. 7. Here two pinions for Dorr classifiers are shown clamped together on an arbor, this method of doubling up the work saving a considerable amount of time.

The illustration Fig. 8 shows a diaphram pump body in position, bottom end up, to have a 3½-in. diameter hole reamed to form the valve seat for a 5-in. ball valve. The operation is performed on a vertical boring mill and a floating reamer is used to machine the seat.

Progress In Welding

THE fabrication of large units by the employment of the welding process, which has been anticipated for some time, is finally coming to pass. The use of arc welding in the construction of several smaller buildings of the steel-and-concrete type has been so successful that work has been started on two large office buildings to be constructed by the same process. One, a 13-story structure, is to be erected in Los Angeles and the other, which will be 14 stories high, is being built in Boston. Another application of welding to the construction of city buildings will be made in Schenectady, N. Y., where a new $1,500,000 city hall is to be constructed by this method. And steel buildings are not the only units in which welding is replacing the use of rivets; a steel vessel has just been completed, the entire hull of which was put together by the arc welding process. Welding is taking its place as an important operation in all kinds of metal fabrication.

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FORMICA

Non-Ferrous Metals and Alloys, III

By GEORGE M. ENOS
Assistant Professor of Metallurgy, University of Cincinnati

This article, which is the third and last of the series deals exclusively with the light aluminum alloys. It discusses the metallography of the alloys, their uses, physical properties, and heat treatment.

THE use of aluminum for industrial purposes has increased very rapidly in the last few years, due primarily to the fact that it is one of the lightest of all metals. No other light metal except magnesium has been produced commercially in any appreciable amounts. Magnesium is, however, a metal of great possibilities, and one whose properties are being studied extensively at the present time. It is this property of low specific gravity, coupled with ease of fabrication, which has made aluminum particularly valuable in the manufacture of automobile and aircraft parts. The property of lightness is common both to aluminum and to its alloys. It has been stated that no casting alloy of aluminum exceeds the density of "commercial" aluminum by more than 10 per cent, and some are actually lighter.

Aluminum in the pure state is unsuitable for the making of good castings. While it is fairly strong in the rolled state, it is relatively weak when annealed. Aluminum of high purity (99.98 per cent aluminum) has a tensile strength value considerably less than commercially pure aluminum (98-99 per cent aluminum), and the commercially pure metal can be strengthened considerably, with alteration of other properties, by the addition of comparatively small amounts of certain alloying elements. As pointed out in a previous article, most products called aluminum are really alloys of aluminum. The two elements most commonly added are copper or zinc, other metals used being silicon, manganese, nickel, magnesium, and iron. It becomes evident that there are a large number of possible alloys of the binary, ternary, or quaternary type. As commercial aluminum contains silicon in appreciable amounts, due to the methods of manufacture, it is also usually present in the alloys.

For convenience, aluminum alloys may be classified into two great groups; viz, (a) the casting alloys, and (b) the alloys which are usually fabricated by working, such as rolling or forging operations. Neglecting small amounts of silicon and iron which are naturally present, the following binary alloys are most commonly used:

Aluminum-Manganese (Manganese not over 2 per cent).

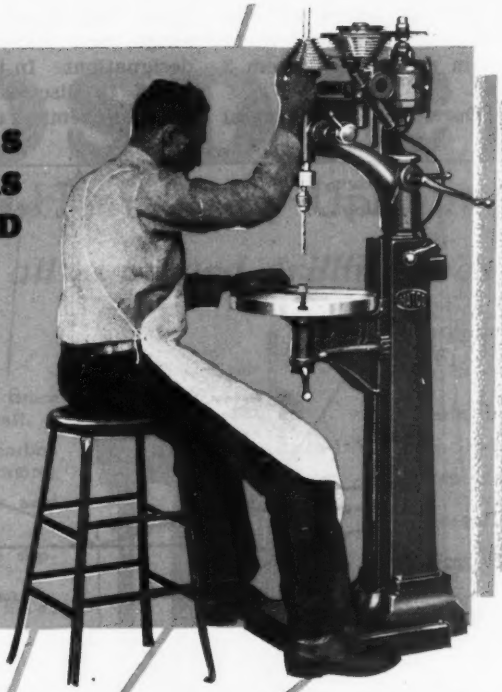
Aluminum-Silicon (Silicon 5, 8, or 13 per cent).

Aluminum-Copper (Up to 12 per cent copper).

Aluminum-Nickel (Nickel 1 to 4.5 per cent).

Aluminum-Zinc (Up to 26 per cent zinc).

The ternary alloys may be based on one of the foregoing binary alloys, with a third element. For example;



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aluminum-copper-zinc alloys vary in copper content from 1 per cent to 12 per cent, and in zinc content from 2 to 30 per cent.

The term "Duralumin" is a general name, commercially applied to various aluminum-copper alloys, the other elements present varying in number and per cent. R. J. Anderson lists 19 compositions. The usual range of composition is stated by Aitchison and Barclay to be as follows:

Copper—between 3.5 and 4.5 per cent.

Magnesium—between 0.4 and 0.7 per cent.

Silicon—between 0.4 and 0.8 per cent.

Manganese—between 0.4 and 0.7 per cent.

Iron—between 0.2 and 0.5 per cent.

Aluminum—balance.

In considering compositions of aluminum alloys, it should be remembered that there are many patented alloys, and many trade names and designations. In this article it is proposed to discuss the alloys on the basis of chemical composition and use, without extended reference to trade names.

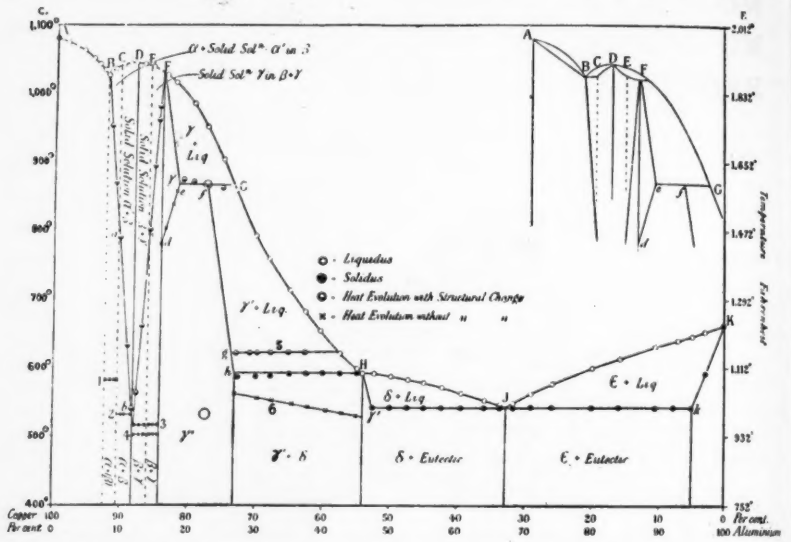

Fig. 1—Aluminum-Copper Equilibrium Diagram (Carpenter & Edwards).

Metallography of Aluminum Alloys

It is beyond the scope of this article to deal at length with the equilibrium diagrams for the various alloys. Many of the commercial alloys contain more than two constituents. For purposes of reference, the aluminum - copper diagram is shown in Fig. 1 and the aluminum-silicon diagram in Fig. 2. Photomicrographs of representative aluminum alloys are shown in Fig. 3.

In the aluminum-copper diagram it will be noticed that solid solutions appear at both ends of the diagram. The aluminum bronzes which usually contain not over ten per cent aluminum with the balance copper are not considered with the light aluminum al-

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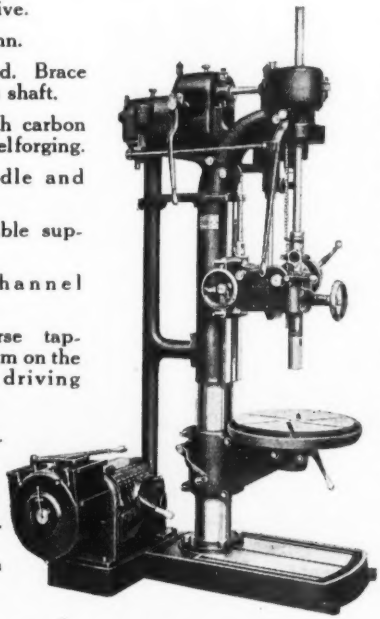

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loys. The light alloys of aluminum and copper are on the aluminum side of the diagram.

Casting Alloys

The properties of aluminum casting alloys that are of interest to the engineer include specific gravity, machineability, tendency to corrode, casting properties, shrinkage, and variations of strength with temperature. Because all of the metals used in forming aluminum alloys, except magnesium, are heavier than aluminum, it is advisable to limit the percentage of added elements, especially for aircraft work. If the copper or zinc percentage be increased, there is probably a greater tendency toward corrosion in the alloy.

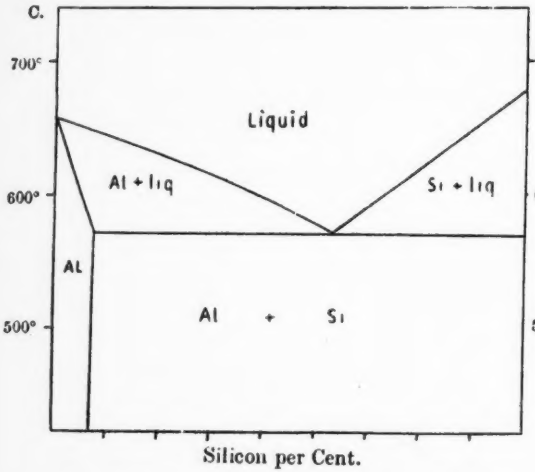

Fig. 2—Alumnium—Silicon Equilibrium Diagram (Hanson & Gayler).

Undoubtedly there are many suitable alloys for casting other than those in common use. The principal aluminum alloys that are suitable for sand casting, together with their properties, are listed in Table I. This table was taken from Tech. Pub. No. 33, A. I. M. & M. E., a paper by P. V. Faragher. In Table II, from the same source, are listed the permanent mold casting alloys.

The details of melting and casting practice need not be discussed at length. It is customary to start by melting aluminum and then adding the additional alloying element or elements, consisting of rich alloys of aluminum and whatever other metal is used, as a "hardener." For example, a hardener for making copper-aluminum alloys could contain about 50 per cent copper and 50 per cent aluminum. Certain difficulties are encountered, however, in melting and remelting aluminum. Aluminum oxide is easily formed in the remelting and may remain entrapped in the casting, since the specific gravity of aluminum oxide, unlike the oxides of other metals, is nearly the same as the specific gravity of the parent metal. Oxide in the metal tends to produce unsound castings. The proper use of scrap and careful control of pouring temperatures must be carefully watched.

Aluminum alloys may be cast in sand molds or in either permanent or semi-permanent molds, and certain alloys may be die cast. The foundry problems involved, while numerous, are beyond the scope of this article. Certain of the casting alloys may be heat-treated, as may be inferred from a consideration of Tables I and II.

Strong, or Wrought Alloys

The strong alloys, considered as suitable for hot or cold working, in-

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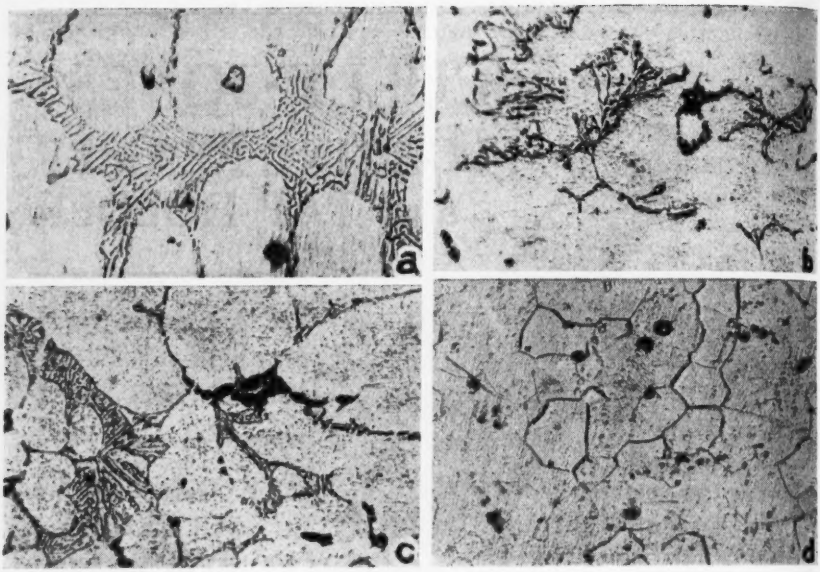

Fig. 3—Typical Micrographs Illustrating Structure of Some Light Aluminum Alloys (Courtesy of R. J. Anderson). (a)—Cast Aluminum Alloys, 1% Iron, Unetched, X 150. (b)—Cast Aluminum-Silicon Alloy, 1% Silicon, Unetched, X 150. (C)—Cast Aluminum-Copper-Nickel Alloy, 90% Aluminum, 8% Copper, 2% Nickel, X 150. (d)—Duralumin Sheet, Etched With Sodium Hydroxide, X 150.

clude the various kinds of Duralumin (whose compositions have been listed above), "Y" alloy, and aluminum-copper-manganese alloy. The "Y" alloy varies in composition; viz, copper between 3.5 and 4.5 per cent, nickel between 1.8 and 2.3 per cent, magnesium from 1.2 to 1.7 per cent, silicon up to 0.75 per cent, iron up to 0.75 per cent. In many respects it is similar to Duralumin. The aluminum-copper-manganese alloy usually runs from 1 to 2 per cent of copper and about 1 per cent manganese. Unlike Duralumin and "Y" alloy, it is not suitable for heat treatment.

Heat Treatment of Aluminum Alloys

If Duralumin be heated to 325 to 350 degrees C. after working, the effect of the work-hardening is removed and the metal remains soft regardless of what method of cooling is used. If, however, the heat treating temperature range is increased to 460 to 480 degrees C. and the alloy is then quenched in water, the material will be relatively soft after quenching but the hardness will be increased gradually if the metal be allowed to stand undisturbed. A stable condition will be reached in about a week, with remarkable improvement in physical properties, and the Brinell hardness number will increase from 65 to 110 during this ageing period.

As would be expected, all of the aluminum alloys can be annealed for the purpose of removing strain. Some of the alloys other than Duralumin can also be hardened by heating and quenching, followed by a period of ageing. The quenching temperature

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Easily bends ½ x 4″ steel to 90° angle.

Straightens a 3″ round bar.

Rivets cold.

Three different leverages. Low speed leverage, 4,000 to one.

Five quick height adjustments.

Overall height, 66″. Width between frame, 21″.

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TABLE I—ALUMINUM SAND CASTING ALLOYS

Alloy No.	Approximate composition per cent		Ultimate tensile strength, lb. per sq. in. range	Elongation Percentage in 2 in.	Approx. yield lb. per sq. in.	Approx. Brinell Hardness No.
100	Aluminum	99.0	12000-14000	15-25	4000	25
12	Copper	8.0	18000-23000	1-3	10000	65
	Copper	7.5				
112	Zinc	1.5	19000-24000	1-2.5	11000	65
	Iron	1.2				
109	Copper	12.0	20000-28000	0-1.5	15000	70
43	Silicon	5.0	17000-22000	3-7	7000	40
45	Silicon	10.0	17000-21000	1-5.3	9000	50
47	Silicon	13.0	24000-31000	5-15	.....	..
	(Modified)					
195	Copper	4.0	28000-38000	6-12	13500	65
195	Copper	4.0	30000-40000	3-8	21000	75
195	Copper	4.0	36000-50000	0-5	27000	100
196	Copper	5.0	33000-45000	0-2.5	27000	110
	Zinc	10.0				
145	Copper	2.5	25000-37000	3-6	12000	65
	Iron	1.2				
	Copper	10.0				
122	Iron	1.2	35000-40000	0-1.0	20000	115
	Magnesium	0.25				
"Y"	Copper	4.0				
or	Nickel	2.0	30000-40000	0.5-2.0	25000	100
142	Magnesium	1.5				

NOTE: The modification process by means of which the properties specified for No. 47 alloy are realized, the production of castings of alloys Nos. 122, 195 and 196 in the heat-treated state, and alloy No. 145 are covered by patents or patent applications owned by Aluminum Co. of America. This table is abstracted from an article by P. V. Faragher, Tech. Pub. No. 33, A. I. M. & M. E.

TABLE II—PERMANENT-MOLD-CAST ALLOYS

(Standard 0.505-in. Test Specimen, Cast in Permanent Mold)

Alloy No.	Approximate Composition per cent		Tensile Strength lb. per sq. in.	Brinell Hardness No.
43	Silicon	5.0	18500 to 24500	40 to 45
	Copper	4.5		
108	Silicon	5.5	21000 to 29500	65 to 80
45	Silicon	10.0	24000 to 29500	45 to 56
	Copper	7.5		
112	Zinc	1.5	21000 to 29000	70 to 90
	Iron	1.2		
	Copper	10.0		
122	Iron	1.2	22000 to 30000	85 to 105
	Magnesium	0.25		
	Silicon	5.0		
125	Iron	1.0	17500 to 22500	40 to 45
	Tin	2.0		
	Copper	5.5		
151	Iron	1.0	20500 to 26500	60 to 70
	Tin	1.0		
	Tin	1.0		
152	Copper	10.0	20500 to 29500	85 to 110
195	Copper	5.5	22000 to 28000	60 to 70

NOTE: Alloy Nos. 122 and 195 may have their physical properties materially improved by heat-treatment. Material in this table is abstracted from an article by P. V. Faragher, Tech. Pub. No. 33, A. I. M. & M. E.

for "Y" alloy, for example, is about 500 C. and the ageing period is about five days.

Machining of Aluminum Alloys

R. L. Templin, of the Aluminum Company of America, has prepared data on the machining of aluminum and its alloys. This material is available in pamphlet form, or it may be found in the handbook of the Ameri-

(Continued on page 76)

Sheldon 90° Angle Plates

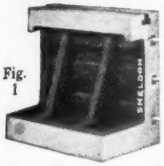


Fig. 1

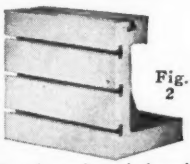


Fig. 2

These Plates are made of semi-steel, heavily ribbed, insuring close-grained, rigid castings.

With Second Face and T Slots

No.	Size Face	Size Top	Size Base	T Slots	Wt., Lbs.	Price, Each
1T	3¾x 5	1½x 5	2½x 5	4–¼″	5	$10.00
2T	6 x 7	2½x 7	4½x 7	4–½″	20	15.00
3T	8 x 9	3 x 9	6 x 9	4–½″	38	20.00
4T	10 x12	3½x12	7¾x12	4–⅝″	75	30.00
5T	14 x16	4 x16	9 x16	4–⅝″	170	45.00

SHELDON 90o PLAIN ANGLE PLATES

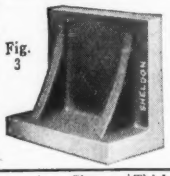


Fig. 3

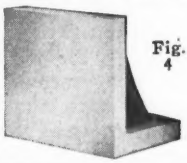


Fig. 4

No.	Size Face	Thickness Face	Size Base	Wt., Lbs.	Price, Each
1P	3¾x 5	½	2½x 5	4	$ 8.00
2P	6 x 7	¾	4½x 7	15	10.00
3P	8 x 9	1	6 x 9	30	14.00
4P	10 x12	1¼	7¾x12	60	20.00
5P	14 x16	1½	9 x16	145	30.00

Sheldon "Set-Up" Jacks

Fig. 1 Planer Jack

Fig. 2 Vertical Jack

Fig. 3 Bracing Jack

PLANER JACKS (Fig. 1)

No.	Height, Contracted	Height, Extended	Diam., Screw	Weight, Lbs.	Price, Each
1	2¾	3¾	⅞	1½	$1.25
2	3¾	5¼	1⅛	3	2.10
3	5¼	7½	1¼	6	3.00
4	7½	12	1½	12	6.00

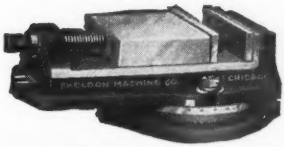
VERTICAL JACKS (Fig. 2)

1	2¾	4	⅝	1½	$ .75
2	4	7½	⅝	2	1.10
3	6¾	12	¾	5½	1.70
4	8¾	15	1	7	2.50

BRACING JACKS (Fig. 3)

1	3¾	6	⅝	1	$ .65
2	4¾	8	⅝	2	1.00
3	6¾	12	¾	3	1.50
4	8¾	16	¾	4	2.10

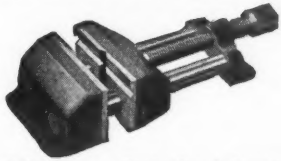
Sheldon Milling Machine Vises



Furnished Both Plain and With Swivel Base.
SPECIFICATIONS AND PRICES:

No.	Width of Jaws	Depth of Jaws	Jaws Open	PLAIN VISE Wt., lbs.	PLAIN VISE Price	SWIVEL VISE Wt., lbs.	SWIVEL VISE Price
3	3½″	1⅜″	2½″	15	$16.00	25	$20.00
4	4½″	1⅝″	3½″	30	$20.00	45	$24.00
6	6½″	2 ″	4½″	70	$30.00	90	$40.00
8	8½″	2½″	7 ″	160	$45.00	225	$60.00

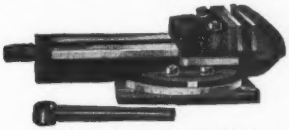
Sheldon Drill Press Vises



Guide Bars are Hardened and Ground.
SPECIFICATIONS AND PRICES:

No.	Width of Jaws	Depth of Jaws over Guide Bars	Full Depth of Jaws	Jaws Open	Wt., lbs.	Price
D 4	4½″	1⅝″	3″	4″	15	$12.00
D 6	6½″	1¾″	3½″	6″	35	$18.00
D 9	9 ″	2½″	4½″	9″	70	$24.00

Sheldon Shaper Vises



SPECIFICATIONS AND PRICES:

No.	Size of Jaws	Vise Opens	Bolt Hole Spacing*	Wt., lbs.	Price
1	12″ x 2½″	12½″	7½″	175	$120.00
2	14″ x 2¾″	13½″	8½″	240	$135.00

*Distance between holes can be changed without additional charge.

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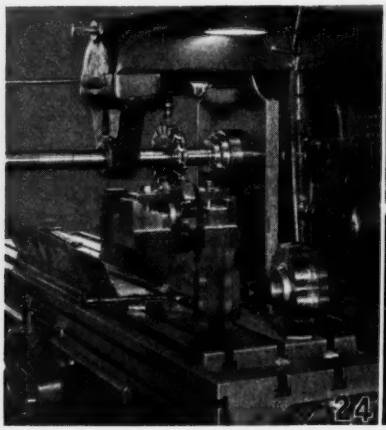
3251 Cottage Grove Avenue, CHICAGO, ILL.

Machining Parts for Wright "Whirlwind" Engines, IV

By PHILIP WINTER

THE connecting rod assembly for the Wright "Whirlwind" Aviation Engine consists of the master rod and either four, six or eight articulated or link rods, depending upon the number of cylinders used. The rods are all of I-section, forged from chrome-nickel steel and finish-machined throughout. The master rod is of one-piece construction and operates in No. 1 cylinder. It has a one-piece, steel-backed, kelmet-lined bearing at the crankshaft end and a bronze bushings at the wristpin end. The widened flanges on the crankshaft end of the rod are bored to receive the articulated rod knuckle-pins.

The first operation on the master rod, which is performed in a turret lathe, is that of rough boring and facing the large end. In the next operation, which is performed on the milling machine shown in Fig. 24, the stock is removed from between the flanges. An 8-in. interlocking cutter is used, operating at 25 r. p. m. and feeding ½-in. per min. The piece is located by means of a pin which is inserted into the hole in the large end of the rod, the ends of the pin protruding and resting in V-blocks Three clamps hold the rod in position. This operation is divided into three settings. In the first setting one side of the rod is milled, then it is turned over and the operation is repeated on the other side, after which a vertical



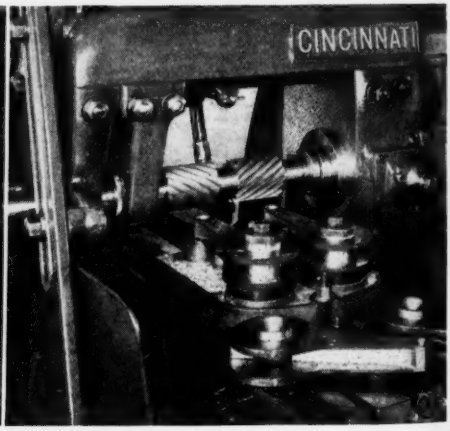


Fig. 24—Milling out between flanges of master rod for 9-cylinder engine. Fig. 25—Milling sides of master rod for 7-cylinder engine.

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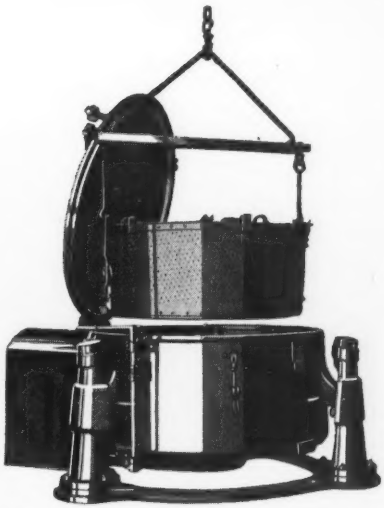

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cut is taken to remove the stock in the end. The vertical cut is taken at a feed-rate of 30 in. per minute.

Figure 25 shows the operation of milling the sides of the master rod for one of the smaller types of motors. A double fixture of the progressive type is used, with which the equivalent of one rod is finished at each cut. The rods are located by studs that fit into the holes in either end, and are held by U-washers and nuts. Stock is removed by two 4-in. spiral milling cutters, and a little more than six rods are finished per hour. The operation cycle is entirely automatic; the operator loads the fixture and throws a lever, the work feeds by rapid traverse to cutting position, feeding at the machining rate until the end of the cut, and then rapid traverses back to the starting position without further attention.

Fig. 26—Milling edges of channels on master rods. This fixture raises and lowers automatically to obtain the correct contour.

Fig. 27 — Rear end of fixture, showing the hinge, cam, and variable feed control.

A fixture of unusual design is shown in Fig. 26, where a horizontal milling machine is shown set up to mill the edges of the channel, the partly-rounded wrist pin end of the rod, and the two flats at the sides of the crankshaft end of the rod. The fixture is of the "rise and fall" type, designed to hold two pieces of work and equipped with cams by which the end of the fixture is raised and lowered, thus making it possible to mill the contour of the rod as specified.

Figure 27 is a view of the rear end of the fixture, showing the hinge upon which the trunnion works, the cam which controls the movements of the fixture, and the variable feed control. The operation is entirely automatic, the fixture rising and lowering at the proper points in the operation, the feed changing automatically with variations in the stock, and the table

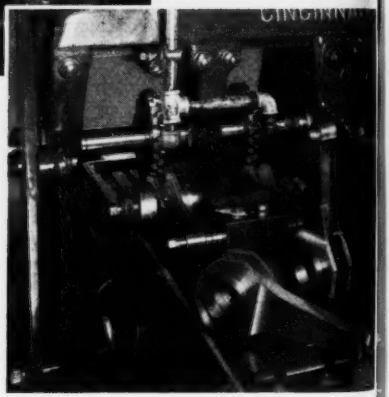

Fig. 28—Rough and finish milling the channels in master rods.

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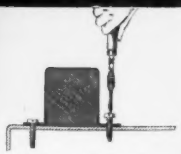

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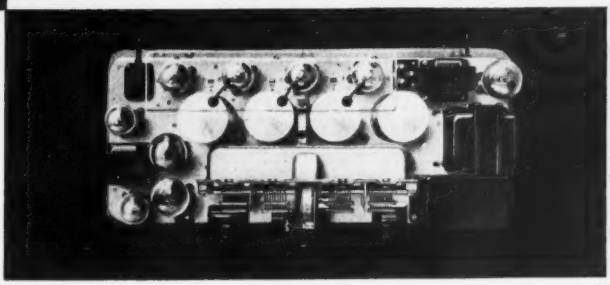

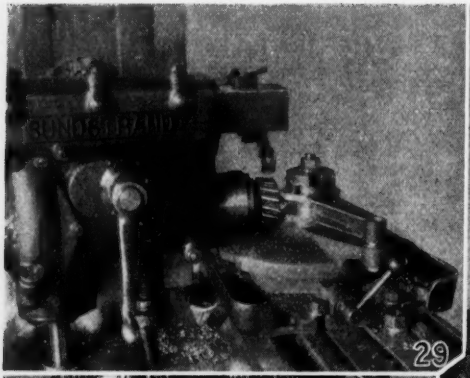

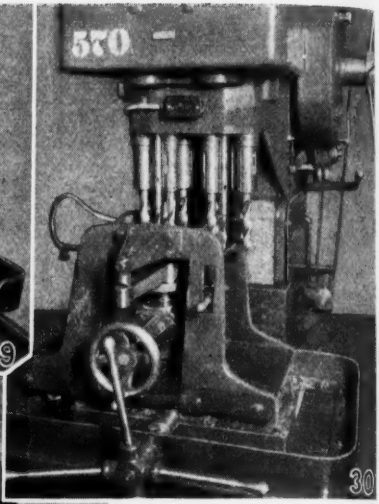

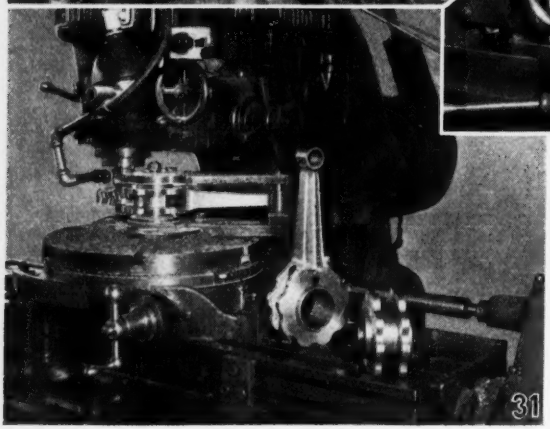

Fig. 29 — Finish milling flats on large end of master rod. Fig. 30—Drilling the knuckle-pin holes in the master rod. These holes are reamed individually. Fig. 31—Rough milling hub of master rod for 9-cylinder engine.

returning to starting position at the completion of the cut. The average time per piece is 4.8 minutes.

A Cincinnati "Hydromatic" miller is shown in Fig. 28, set up to rough and finish mill the channels in the rods for the seven-cylinder engines. The fixture holds two rods, the rod on one side of the fixture being milled on one side in one operation and on the other side, on the opposite side of the fixture, in the next operation. Two sets of 10-in. plain staggered-tooth slotting cutters are used on the roughing operation, operating at a speed of 16 r. p. m. and feeding from 1 in. to 1⅝ in. per minute. The time per piece on this operation is 16.3 min. At this point the rods are heat treated to about 320 Brinell, then they are finished in this same fixture with two sets of 10-in. interlocking cutters which revolve at a speed of 22 r.p.m. while the table is feeding 4½ in. per minute. Approximately ⅞ in. of stock is removed in the finish operation. The net production is a little more than 3 pieces per hour.

In Fig. 29 is shown the operation of finish milling the flats on the large end of a master rod. The rod is located on two pins in an indexing fixture on the table of a Sundstrand "Rigidmil," and the machining is done by a large end mill. Approximately $\frac{1}{16}$ in. is taken off, leaving .008 to .010 in. to be removed by polishing.

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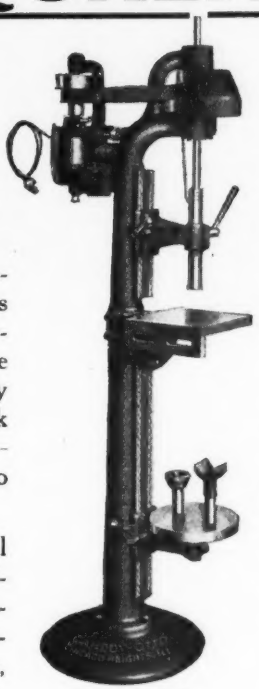

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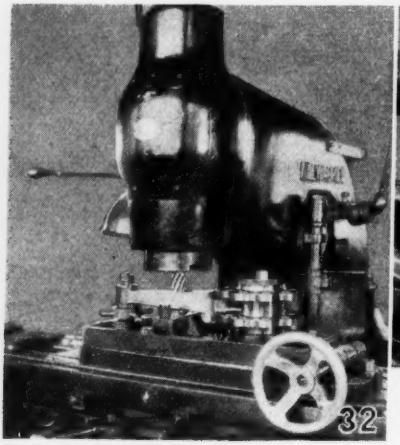
The multiple drilling machine shown in Fig. 30 is set up to drill the nine 53/64-in. holes in the master rod for the 9-cylinder engine. As the holes are too close together to drill all the holes at one setting, the machine is equipped with two drill heads, one with five spindles and the other with four. After the first five holes have been drilled, the jig is moved over and the remaining holes are drilled. The holes are finished to size by reaming, each hole being reamed individually with a 27/32-in. reamer to insure accuracy. When finished, the holes must be within .0005 in. of drawing size.

In Fig. 31 a Cincinnati No. 4 miller is shown in process of rough milling the hub diameter of a master rod for the 9-cylinder engine. The piece is held in a special fixture that is bolted to the table of a 20-in. circular milling attachment. The attachment is bolted to the machine table and is revolved by means of the shaft and gearing at the right end of the table. The stock is removed with a pair of 6-in. interlocking cutters mounted on a stub arbor.

The next operation on the master rod is that of milling the channel, which is done on a Milwaukee vertical miller as shown in Fig. 32. The rod is located by studs in the fixture, which slip into the holes in either end of the rod. The fixture consists primarily of a base and an upper section, the upper section being pinned to the base at one end so that it can swing, and being controlled at the other end by a rack and worm to which a handwheel is attached. The length of the channel is controlled by stops which limit the table feed, and the width is controlled by the handwheel. With the free end of the fixture over in one direction as far as it will go, the cut is started with the cutter feeding toward the small end of the rod. At the limit of the cut, the moveable end of the fixture is moved in the opposite direction as far as it will go and the cut is reversed, thus leaving the wall of the I-section of uniform thickness regardless of the fact that the channel is wider at one end than at the other.



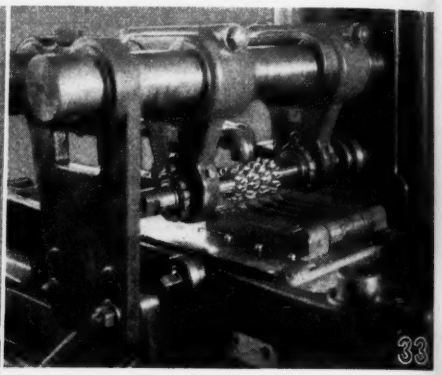
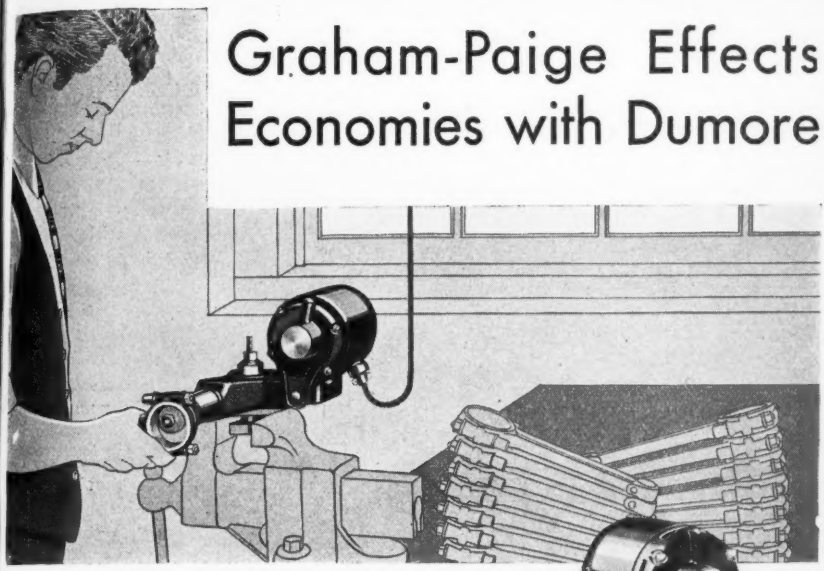


Fig. 32—A triangular-shaped channel is milled in the master rod with this equipment. Fig. 33—Milling channels in the link rods.

The articulated or "link" rods are

Graham-Paige Effects Economies with Dumore



Grind 3000 connecting rods per day with No. 5 Dumore

WORKING at high speed, grinding 3000 connecting rods per day, taking two cuts on each rod, holding up under extra pressure, producing more finished work and doing it quicker, cheaper and better — this is the Dumore Grinder accomplishment in the Graham-Paige plant!

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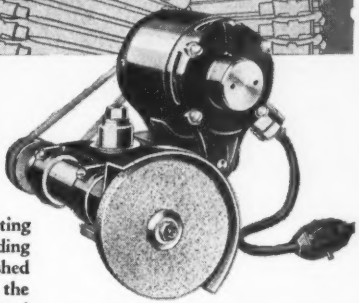

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also of I-section chrome-nickel steel, finished all over. After rough-drilling, the rods are placed, four at a time, in the fixture shown on the Mil-Waukee-Mil shown in Fig. 33, where the channels are milled out. The fixture is of the cam-operated type, designed to feed the work up onto the cutters, feed horizontally to the opposite end of the rods, then lower so that the proper contour will be milled at each end of the rod. Four staggered tooth cutters are used and the depth and width of the channel is held to within .005 in. of drawing size.

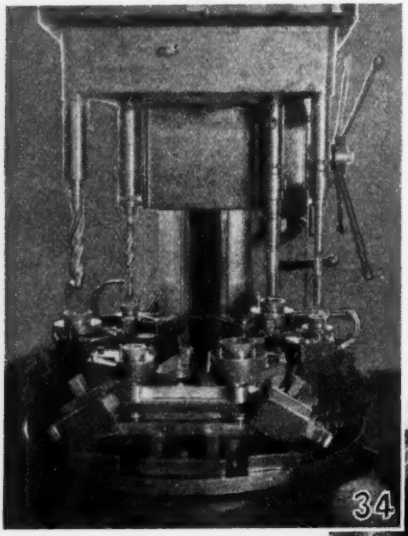


Fig. 34—Drilling and reaming the knucklepin holes in the link rods.

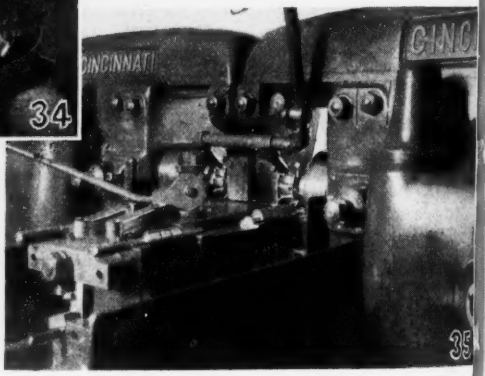


Fig. 35—Form-milling ends of link rods, using two cutters and a four-station fixture.

The equipment used to drill and ream the wristpin and knuckle-pin holes in the link rods is shown in Fig. 34. The machine is a 4-spindle drill with a rotating table upon which is mounted three fixtures, the third fixture providing for loading while the machine is in operation. The smaller drill and both reamers are piloted to ensure perfect alignment. As the head moves downward, the drills and reamers feed through the work and the head then reverses until the tools are clear of the work, at which point it stops. The table is then indexed and the operation is repeated, the operator changing the pieces in the third jig while the others are in process. The diameters of these holes are held to ± .001 inch.

The ends of the link rods are finished by milling in the Cincinnati Duplex Hydromatic miller shown in Fig. 35. Two 5-in. special form-cutters and a fixture with four work-holding stations are used, making it possible to load one end of the fixture while the other end is in process, and producing 8 rods at a time. Four rods are held in each station by means of hardened steel mandrels which are inserted through the wristpin and knuckle-pin holes, the mandrels resting in half-round grooves in the fixture. A hand-operated clamp bearing on the lower mandrel holds the rods together and

(*Continued on page* 108)

Ideas From Readers

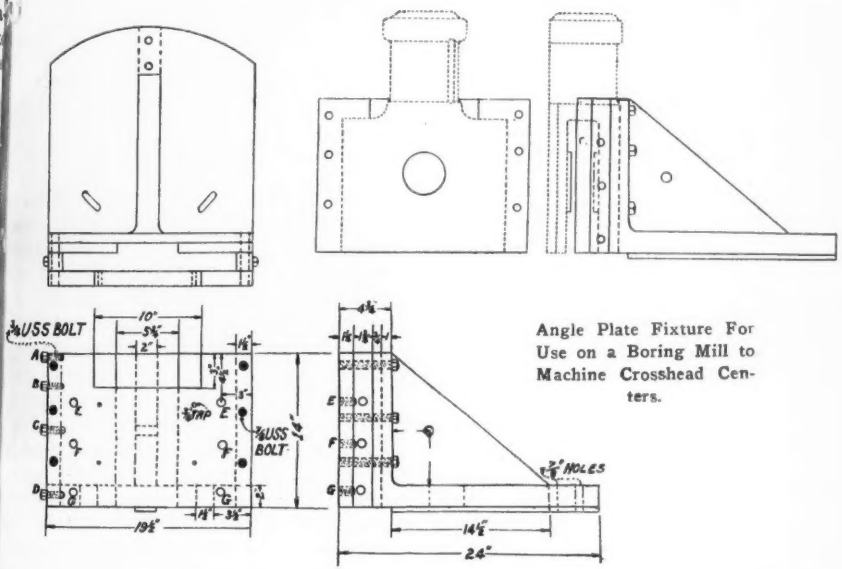
This department is a clearing house for ideas. If there is a "kink" or short-cut in use in your shop, send in a description of it. We will pay $5 for each one published.

Fixture For Machining Crosshead Centers

By J. H. HAHN

THE illustration shows how an angle plate can be utilized as a fixture for machining the crosshead centers of the "alligator" type crossheads with detachable shoes. This fixture was designed for use on a 54-in. vertical boring mill, to machine crosshead centers in quantities on a production basis, and will be found both efficient and economical for the work for which it is intended.

The center is first machined on the inside for the crosshead shoe fit, the sides are faced to the proper dimensions, the wrist pin hole is bored and reamed, and the inside of the center is faced for main rod clearance. The center is then located in the fixture as shown, and is locked in position by the bolts **A, B, C, D, E, F,** and **G.** The bolts **E, F, and G** hold the crosshead firmly against the fixture. A hole is now drilled in the "nose" of the center, and the piston rod fit is machined. The nose of the piece is then turned on the outside and finished by facing on the upper end.



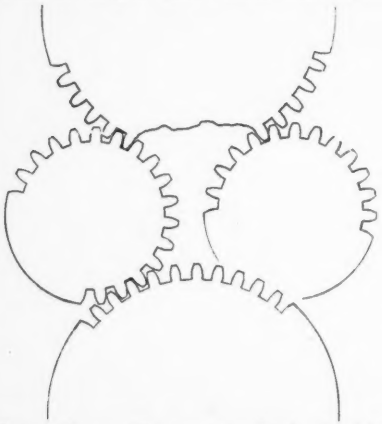
Angle Plate Fixture For Use on a Boring Mill to Machine Crosshead Centers.

An Emergency Gear Drive

By C. G. CROWLEY

WHEN six of the 49 teeth broke out of a cast iron gear, a very important production machine was shut down. Efforts to obtain a new gear indicated that it could not be obtained in less than two or three days, and as a shutdown of this length could not be tolerated, it became imperative that some means of operating the machine be found.

The broken gear was one of a train of three, a central pinion being employed to impart reverse motion to the upper and lower gears. The pinion was removed, and two gears with teeth the same pitch as those on the machine were attached so that the teeth of both of the auxiliary or intermediate gears meshed with the teeth of the upper and lower gears, as shown in the illustration. With the gears arranged thus, while the broken



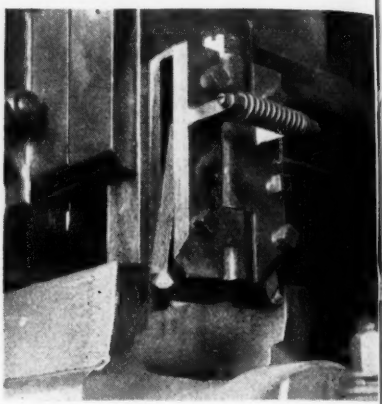
The two intermediate gears maintain the drive between the upper and lower gears, even tho one is broken.

section of the upper gear was passing one of the intermediate gears, the teeth of the upper gear were still in mesh with the other intermediate gear and the drive was maintained.

Double-Type Clapper Box For Planing Cross Slides

By FRANK C. WALDO

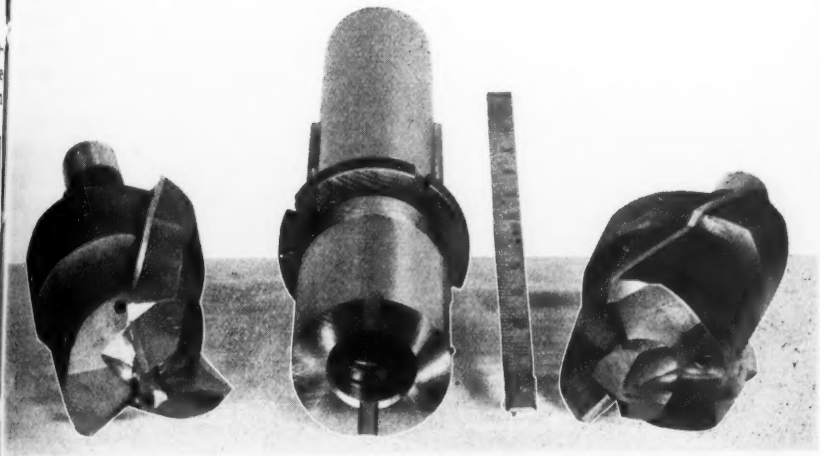
AN efficient way to machine locomotive cross slides is to handle as many operations as possible in



Double Clapper Box for Planing Cross Slides.

pairs and to machine two surfaces at a time, so as to reduce the machining time. An effort to save time in finishing the inside surface of the top and bottom flanges led to the construction of the double-type clapper box shown in the accompanying illustration. Instead of having the pin in a horizontal position, according to the usual construction, the unit is made with a vertical pin on which two toolholders are mounted in the manner of hinges. Each toolholder is provided with a slot to accommodate a one-inch square forged tool which is held in place by set screws. The toolholders are connected by a helical spring so that they will remain in the cutting position except when swung forward on the return stroke of the planer. The device is easy to construct and saves a considerable amount of time.

Even on Airplanes---



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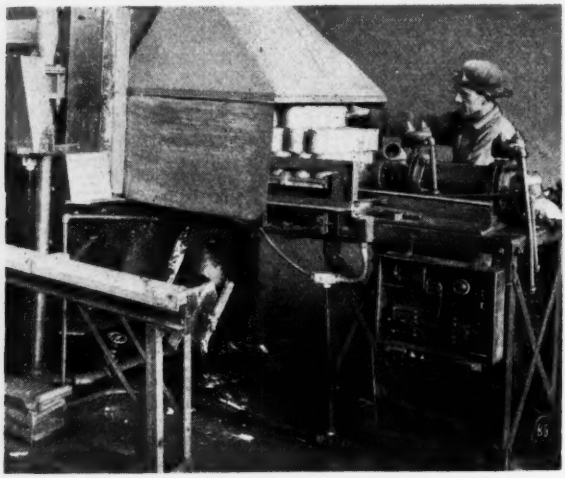
Air-Operated "Pusher" Feeds Annealing Furnace

By JOHN MCCULLAGH

IN laying out the installation of a pusher-type furnace for annealing pistons, it was decided to place the work on cast iron trays. The trays were made large enough to handle 60 pistons on units of two trays each, each unit being considered as a charge. Inasmuch as the work had to be ejected at the opposite end of the furnace, a roller conveyor was installed adjacent to the furnace so that the trays could be returned to the starting point. The work is fed into the furnace by means of an air cylinder, the piston of which acts as a pusher, and has a horizontal movement of 12 inches.



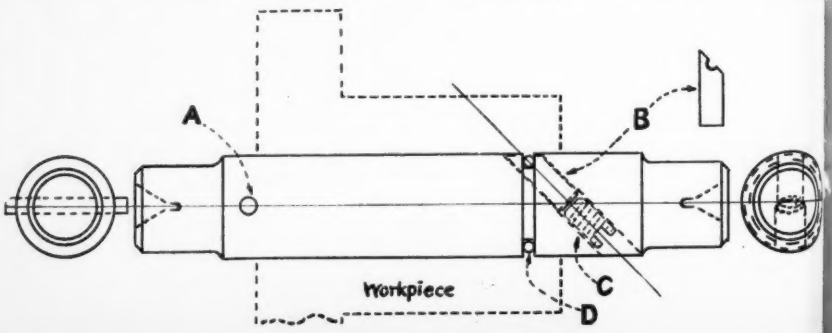
Pistons being fed into annealing furnace by air-operated pusher.

The illustration shows the loading end of the furnace, with a charge ready to be started through, the operator in the act of opening the air-valve. The pistons are treated at 1160 degrees F. for two hours before machining. This annealing operation removes the strains and stresses set up in casting and renders the pistons tough and durable. The roller conveyor can be seen in the foreground.

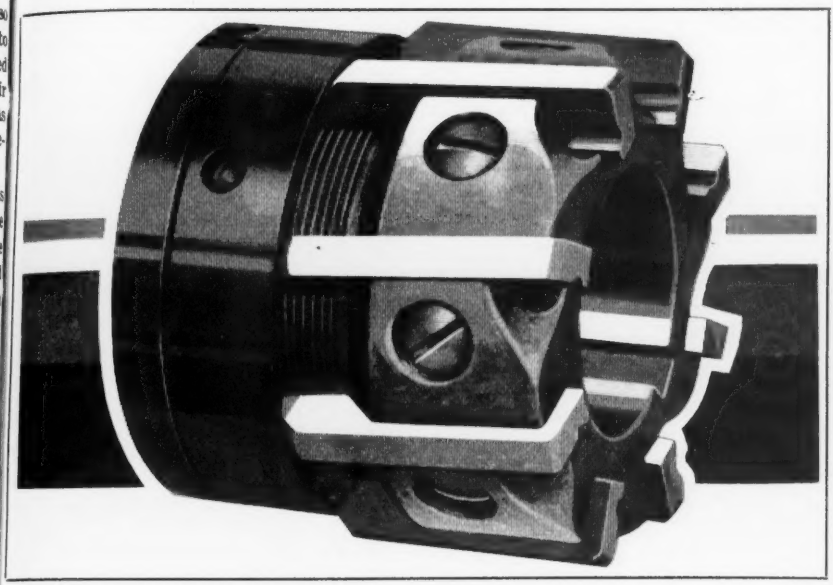
Locking Mandrel For Heavy Work

By ERNEST FOLDVARY

THE drawing shows a mandrel which was made to hold heavy ring forgings for facing. The hole in



Locking Mandrel for Heavy Work



Sturdy Reamers for Sturdy Bars

THIS McCrosky-SUPER Shell Reamer is designed for line bar reaming. It has an extra large straight hole that permits the use of a large, sturdy bar. The compact over-all length accommodates the reamer to limited clearances. The reamer body is hardened to protect it from damage and wear. The blades are held rigidly in place by a simple and positive lock which works with and not against the cutting thrust. New blades can be readily inserted in the original body, renewing the life of the reamer and cutting the cost of accurately finished holes. These features are incorporated in nine other styles of standard McCrosky-SUPER Reamers that produce uniform holes with economy. Bulletin No. 11-A will give you details and show many installations of SUPER Reamers on definite jobs. Send for a copy.

McCrosky Tool Corporation, Meadville, Pa.

Branches in Cleveland, Detroit and Chicago.

McCrosky-SUPER Adjustable Reamers

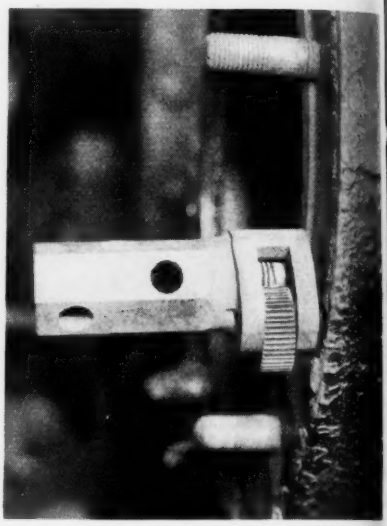
the forging was finished to close limits, and the mandrel was made to a sliding fit. The design of the mandrel incorporated two advantages; it provided an accurate stop and thus saved the time that otherwise would be spent in gauging and in resetting the tool, and it provided means for preventing the work from slipping under a heavy cut.

The stop pin is shown at **A**. Detail **B** is a pin which slides in a hole drilled through the mandrel on an angle as shown, the setscrew **C** serving both to hold the pin in the hole and to provide means for applying pressure against the rear end of the pin. A heavy spring **D** pushes the pin back into the hole as the screw is withdrawn. The work is slipped onto the mandrel to the stop pin **A**, then the screw **C** is fed in, forcing the pin **B** against the inner wall of the bore in the piece. The area of contact between the end of the pin and the wall of the piece is apparently small, but the pressure of the pin is so effective that an exceedingly heavy cut can be taken without disturbing the setting of the workpiece. This mandrel worked effectively when all other means had failed.

"Big 4" Stud Wrench

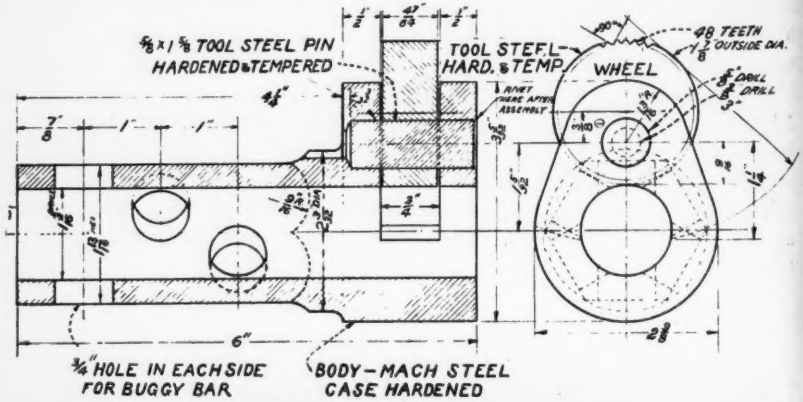
By August Jacob

THE illustrations show a reversible stud wrench which has been developed for use in the Beech Grove



"Big 4" Stud Wrench in Position for Use

shops of the "Big 4" Railway. The grip on the stud is obtained by means of an eccentric wheel in which 48



Details and Dimensions of "Big 4" Stud Wrench

For Centerless Grinding---

Roughing, Finishing and Regulating Wheels

CENTERLESS grinding requires a closer fitting of the wheel to the work than any other grinding operation. A simple change in grain size or grade of hardness will not always satisfy. There are other variables which must be made use of if the most suitable wheel is to be supplied. With Norton control of the small variables the exact wheel to meet the rigid requirements of centerless grinding can be furnished. Let us supply wheels tailored to your individual requirements.

W-280

NORTON
GRINDING WHEELS

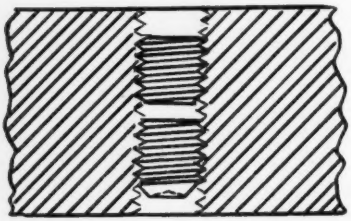
NORTON COMPANY WORCESTER, MASS.

teeth are cut, as shown in the drawing. The body of the tool is of machine steel, case hardened, and the wheel is of hardened and tempered tool steel. The hexagon shape of the body provides for the use of a wrench with 1⅞-in. opening, or a buggy bar may be inserted through the holes. The feature of the wrench lies in the fact that the greater the leverage required to turn the stud, the firmer the grip taken by the tool. The tool works equally well for driving or for pulling studs.

Locking Headless Setscrews

By ARNOLD R. FINCH

EVERYONE who uses setscrews has probably encountered the trouble of having the screws work loose, due to the jarring or chattering of the machinery in which they are used. The lock washer cannot be used, as is possible with a fillister head screw or cap screw, so the evil



One headless setscrew can be used to lock the other in position.

continues. The difficulty has been overcome in our shop by the use of two socket head or "headless" setscrews in one screw hole, one serving to lock the other. The first screw is tightened in the usual manner, then a second screw is tightened down against the first, thus jamming the threads of both. If all the screws on hand have cup points, it is better to grind the cup off the top one, thus eliminating the danger of damaging the socket of the first screw. The range to which this expedient is applicable can be estimated from the fact that we use the above method on a sleeve that is fastened onto a ½-in. diameter motor shaft, in which a $\frac{3}{16}$-in. screw is used, and on a pulley on a large draw press having a 3-in. shaft and using a ¾-in. screw.

Non-Ferrous Metals

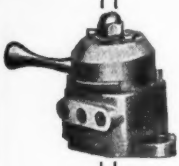
(*Continued from page 54*)

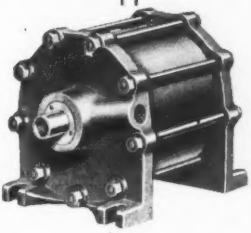
can Society for Steel Treating. The following material is abstracted from Mr. Templin's article, but the original source should be consulted for details.

Certain changes may have to be made in the shapes of tools ordinarily used for brass or steel if they are to be used in machining aluminum. Cutting tools for aluminum alloys should have more top and side rake than tools used for steel. The recommended angle of top rake is approximately 45 degrees, with a side rake of from 10 to 20 degrees and clearance of 6 degrees. Edges should be very keen, and hand stoning of the edge may be advisable.

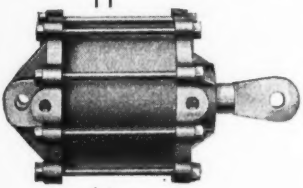
In ordinary engine lathe work, the tool should be set so as to avoid curling the chip any more than is necessary. Allowance should be made for increases in temperature when heavy, coarse feeds are to be used. Usually a lubricant or cutting compound is an advantage, although some alloys may be machined without it.

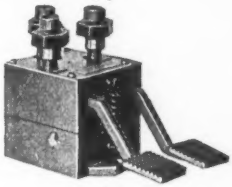
Naturally certain precautions must be used in such operations as filing, grinding, and in using milling cutters, drills, or reamers. Aluminum and its alloys can easily be sawed with circular or band saws. These metals will also take a very satisfactory polish, or, if desired, a finished surface may be secured by sand blasting, dipping, or scratch brushing.





"LOGAN-" EQUIPPED





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Over the Editor's Desk

"Modern Tooling Practice"

NO machine shop executive is fully equipped for his task, these days, unless he has at least a working knowledge of the principles of tool, jig, and fixture design. While it is true that the large so-called production plants are equipped with corps of draftsmen whose task it is to design the tools, in many cases a thoroughly up-to-date foreman can offer suggestions by which the tool can be improved. Again, if the operating executive is familiar with the principles of tool design, he often is able to originate ideas for reducing time or eliminating labor by the use of special labor-saving devices. A knowledge of tooling principles is practically indispensable to the small shop executive upon whom rests the entire responsibility for the efficiency of the shop methods.

Upon page 11 of this issue will be found the first article of a series which will give the reader a clear idea of the basic principles of tool design and construction. The author of this series of articles, Frank W. Curtis, is well-known to the metal-working industry, and is the author of a number of books on engineering subjects. The series, when completed, will form a valuable addition to any executive's technical library.

Change

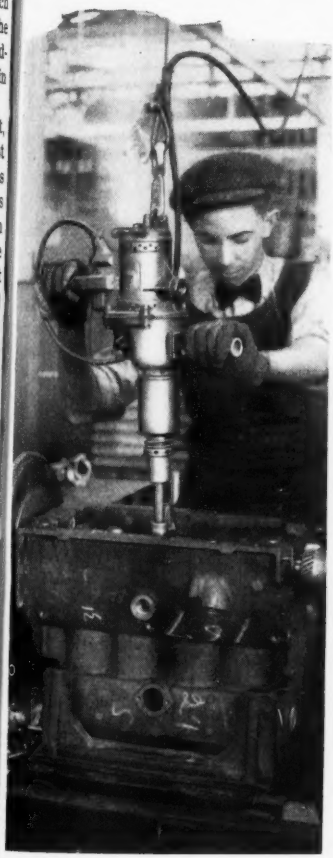
C. F. KETTERING says, in an interview in "Nation's Business": "You must recognize that your business is going to change. Then you must be able to recognize what factors are going to make it change and have those factors digested in your organization before the public demands the change . . . If you do not like to travel at the rate at which you have to travel, step out of the line and be a good spectator and advisor of those who want to stay in the race."

Mr. Kettering is saying, in effect, "If you want to stand still, you must keep moving." The firm that keeps in the front ranks of successful firms will never have the time to rest upon its laurels. The firm that takes time out for a rest will find, later on, that while it was resting the others forged ahead, and left it behind. There is only one way to continue to be successful, and that is by being on the alert for newer and better ways of handling the task, and by being ready at any time to replace older methods and tools with more modern equipment.

Still Growing

BUSINESS has been slow. Money has been tight. Economy has been the order of the day, but—the growth of MODERN MACHINE SHOP has been steady and continuous. We hope that the machine shop executives to whom this magazine goes derive the same satisfaction from this fact that we do, because to these same readers is due the credit for this growth. It would appear that the majority of our readers find this magazine both interesting and useful. If there are any who do not, we hope that they will write and tell us what kind of information they need, or what sort of editorial material would be most helpful to them.

Creating a *New Standard* of Portable Tool Efficiency



Thor HIGH FREQUENCY ELECTRIC TOOLS

Make Possible Startling Production Advantages

THE three outstanding advantages of Thor High Frequency Electric Tools are: **Constant rate of speed—simplified construction —light weight.**

Constant rate of speed offers tremendous possibilities in increasing production. Each operator's output is increased several times with no strain on man or machine.

Simplified construction eliminates the use of commutators and brushes, which have caused trouble in most Universal motor tools. This improved feature eliminates the frequent servicing heretofore necessary.

Light weight results in easier handling by workmen, assuring greater efficiency. This feature also makes possible the use of only one man on heavier jobs, which heretofore always required two men because of the size and weight of the machine used.

No matter what the operation — drilling, reaming, tapping, screw driving, nut driving, grinding—it can be accomplished more quickly and efficiently than ever before.

Investigate these new tools. Learn what they are doing for others and what they can do for you. Complete information is yours for the asking.

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PNEUMATIC TOOLS — ELECTRIC *Thor* TOOLS — AIR COMPRESSORS

236 S. JEFFERSON ST. CHICAGO, ILLINOIS

New Shop Equipment

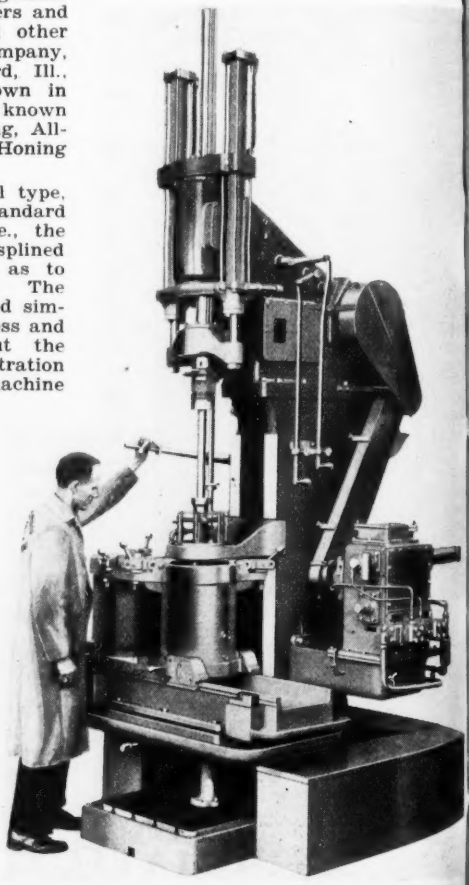
Barnes No. 2420 Medium Heavy Duty Honing Machine

To provide a means for economically producing a smoother finish and greater accuracy in Diesel engine cylinders and liners, locomotive cylinders, and other similar parts, the Barnes Drill Company, 801-851 Chestnut Street, Rockford, Ill., has developed the machine shown in the illustration. This machine is known as the Barnes No. 2420 Self-Oiling, All-Geared Medium Heavy Duty Honing Machine.

The machine is of the vertical type, and incorporates the Barnes standard fundamental characteristics; i. e., the reciprocating and rotating ten-splined spindle, hydraulically controlled as to length and rapidity of stroke. The spindle is reciprocated and rotated simultaneously, to provide for evenness and uniformity of finish throughout the length of the pieces. The illustration shows the right side of the machine with the WEA Oilgear pump and silent chain drive in position.

The machine has 24-in. swing, and will hone cylinders up to 20 in. diameter. The spindle stroke is 32 in., although longer or shorter strokes can be provided. The rigid spindle construction and duplex hydraulic cylinders directly connected to the lower end of the spindle for reciprocating motion are important features of the machine. Parallel hydraulic cylinders on opposite sides of the spindle housing minimize the height of the machine while allowing various lengths for variations in spindle stroke. A yoke connection to the spindle provides for the attaching of multiple heads when desired.

The ten-splined spindle is driven by a hardened steel bevel crown gear with inserted Ackermite bronze hub, 7 in. long, both hub and splines being self- oiling. The spindle and hone assembly is counterbalanced. Four quick change spindle speeds are available. Machine



Barnes No. 2420 Medium Heavy Duty Honing Machine.

LITTLE LESSONS IN GRINDING COSTS

"THE art of grinding has advanced a great deal since I started selling wheels over forty years ago," O. H. Hyde was saying.

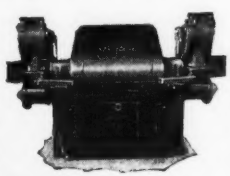
"It wasn't so many years ago that we used to have a sort of blind faith in the vagaries of ceramics. We would select a wheel by guesswork, mount it on a misfit contraption of a grinder, and trust to luck that the wheel would do a decent grinding job.

"Now we specify a definite grain and grade and size of wheel with something like scientific precision. We know that, generally speaking, the larger the wheel the less the cost of abrasive.* We know that, within the limits of mechanical and ceramic restrictions, the faster the surface speed of the wheel, the quicker and cheaper the work can be turned out. But we have found out that modern high-speed, organic bonded wheels *must* be held within narrow limits of speed variation, and must be used on properly designed grinding machines, or their advantage entirely disappears.

WHAT THE CHART SHOWS

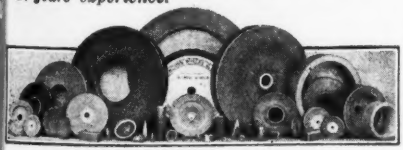
"A 30 in. diameter wheel, for instance, at 9,000 s.f./min. initial speed will have been slowed down to 4,500 ft./min. by the time it is worn down to 15 in. dia., if the spindle speed has not been increased. If the wheel was not too hard to do a good cutting job at 9,000 ft. speed, it is entirely too soft for effective grinding at, say, 7,200 ft./min., or 20% less than the speed for which it was designed. (*See Curve A on chart.*)

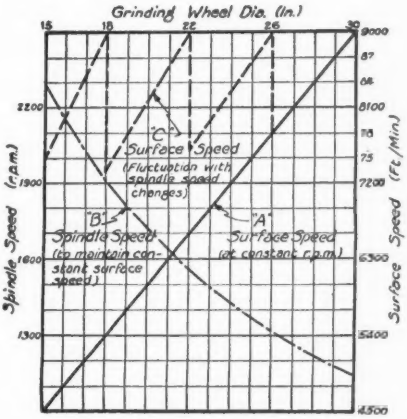
"The ideal condition would be to *constantly* increase the rotative speed as the wheel wore down, to maintain constant surface or peripheral speed. (*See Curve B on chart.*) Mechanical and electrical limitations make that impractical however,† so the 'Rite-Speed' Grinder is designed to permit—in fact, to *automatically enforce*—the speed to be increased periodically as the wheel wears down (*See Curve C on chart*).



The SAFETY "Rite Speed" Grinder automatically enforces an increase in speed as the wheels wear down, thus insuring more efficient grinding and lower costs.

"A wheel for every need" . . . backed by 37 years' experience.





so that the maximum variation in the surface speed is never more than 18.1% throughout the life of the wheel.

"That's what makes SAFETY 'Rite-Speed' Grinders pay for themselves in such short order by savings in grinding costs."

* * * * *

Would *you* like to know more about the remarkable "Rite-Speed" Grinders? The positive *mechanical* means by which they control the surface speed of grinding wheels is protected by basic patents. The coupon below will bring you full details. Use it *today*—for greater profit tomorrow.

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* See third preceding adv. in this series.
† See next following adv. in this series.

We will send you proofs of both advertisements if you wish.

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2344 Columbus Ave., Springfield, O.
Please send us file data regarding:
( ) "Rite-Speed" Grinders.
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(Name of Individual)
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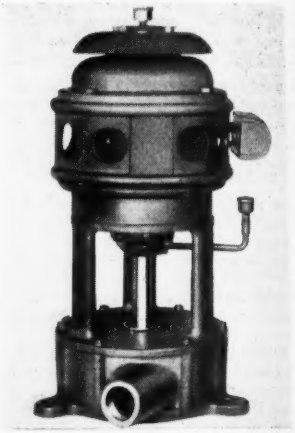
fully equipped with radial ball bearings and Timken roller bearings, including the spindle, all self-oiling. Back gears to provide four extra speeds can be furnished if requested.

The height of the machine is 12 feet. Distance, center of spindle to face of column, 12¼ in. Maximum distance from finished surface of base to nose of spindle, 77¾ in. Maximum distance from top of table to nose of spindle, 64 in. Minimum distance from top of table to nose of spindle, 9 in. Spindle stroke, 1 in. to 32 in. Diameter of spindle, driving end (No. 4 Morse taper), 3 in. Size of table, working surface, 18x28 in. Vertical travel of plain table, 23 in. Spindle speeds, four speed machine with 2 to 1 crown gearing ratio, drive shaft 400 r. p. m., 354, 250, 180, and 128 r. p. m. When back geared, the four additional speeds are 89, 63, 45, and 32.

Motor recommended for cylinders up to 10 in. diameter, 10 h. p., 1200 r. p. m. For cylinders 10 to 15 in. in dia., 15 h. p., 1200 r. p. m. Cycles of reciprocations (down and return), 20 to 50 as adjusted by Oilgear pump control. Floor space required, including filtering tanks, width and front to back, 56x 54 in. Net weight with Oilgear hydraulic pump, motor, starter, and filter, 6,000 lb. Weight, crated, 6,600 pounds.

Ruthman Two-Stage Vertical Motor-Driven Pump

The Ruthman Machinery Co., 532 East Front St., Cincinnati, Ohio, has added a two-stage pump—the Model A-L—to its line of vertical motor-driven pumps. The pump, which is shown in the illustration, is capable of developing lb. pressure per square inch, enab

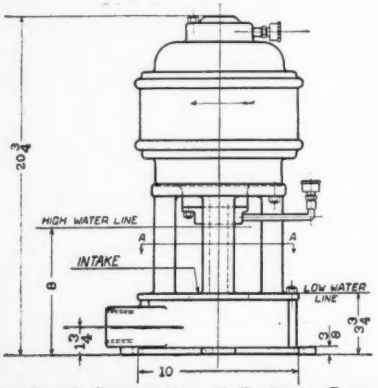


Ruthman Two-Stage Vertical Motor-Drive Pump

it to pump to a height of 90 feet. T pump is equipped with a 1½ h. p. moto speed 1,725 r. p. m.

Like all Ruthman Gusher Pumps, t pump is constructed without packin which type of construction is intend to eliminate friction. This design pe mits the full benefit of the ball-bea ing construction to be obtained, t gether with full utilization of the pow available. The intake is constructed wi a stationary device of three curv blades to prevent the fluid being pump from whirling and forming a conic shape. This feature prevents the e trance of air, making the flow sol and free from bubbles.

The pump is particularly adapted f supplying coolant to a number of ma chines from a central reservoir, there by eliminating the necessity of individu pumps, for creating pressure in co nection with various types of hydra lic movements, or for use in connectio with air cleaning or humidifying sy tems.



Details of Construction of Ruthman Pump

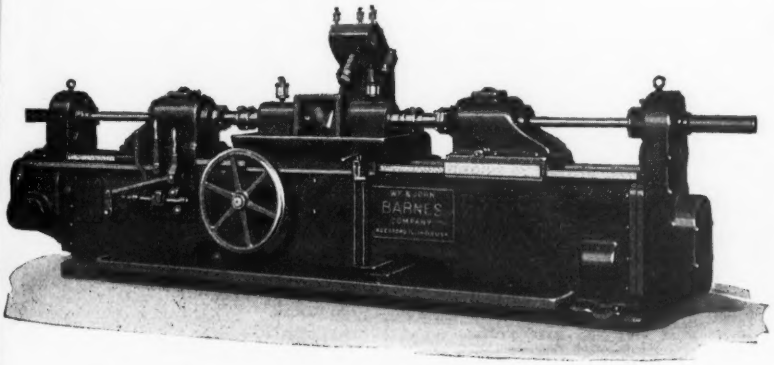
Hammond Double Disc Grinde

The illustration shows a double di electrically-driven grinding machin which has been developed by the Ham mond Machinery Builders, 1622 Doug Ave., Kalamazoo, Mich. This machin

BARNES

HORIZONTAL DUPLEX and SINGLE HEAD

PRODUCTION BORING and DRILLING MACHINES



BARNES No. 420 Horizontal Duplex Differential Carrier Boring and Tapping Machine.

May we have your inquiries for Production Boring Equipment?

W. F. and JOHN BARNES CO.

ROCKFORD, ILLINOIS

Upright Drills Screw Presses

Horizontal and Vertical Production Drilling and Boring Machines

SAVE 90%

on the cost of cutting irregular shapes in sheet metal with

THE NEW
No. 4 Heavy Duty
HANDNIB!

THIS tool will also make a substantial saving in time and will give you a better job than the old method of drilling out a shape and filing the edges.

It will nibble sheet metal up to $\frac{3}{16}$" thickness into any shape, inside or outside, shear flat stock up to $\frac{3}{16}$" thickness, and cut rods from $\frac{1}{16}$" to $\frac{1}{2}$" diameter. The double crank construction makes it the easiest hand-operated nibbler on the market.

Get a copy of the HANDNIB Folder. It tells all about the new No. 4 heavy duty machine and how it can be used in YOUR shop. SEND THE COUPON NOW!

NATIONAL MACHINE TOOL CO.
1542 CLARK STREET, RACINE, WISCONSIN

Send me a circular on the new HANDNIB.

Name..... Title.....

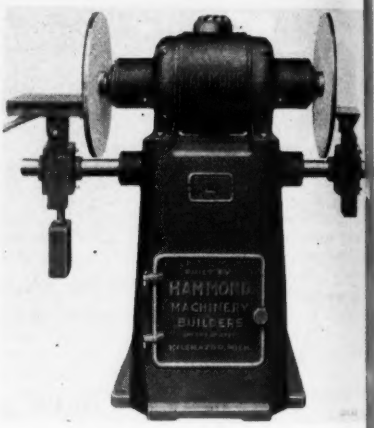
Firm .....

Address .....

City..... State.....

like all Hammond electrically-driven grinders, has a totally-enclosed sealed motor, cooled by a fan mounted on the spindle. All incoming air passes through the air cleaner, which is mounted directly in back and connected through the pedestal to the cored end bell. At the same time the warm air is discharged through an outlet in the pedestal, eliminating all grit and dust. The motor is especially designed for this service, operating at less than a 40-degree temperature rise and having a high overload capacity.

The spindle is unusually large, made of chrome nickel steel, and ground and balanced to insure smooth operation. The bearings are also unusually large and are especially designed to take care of both radial and lateral thrust. The discs are machined on both sides and are reversible so that two disc wheels can be mounted at one time. After one is worn, the disc can be reversed, making it possible to obtain



Hammond Double Disc Grinder

twice the usual amount of service with one operation of changing and mounting disc wheels.

Standard equipment includes one plain table and one lever feed table as shown. The machine can also be supplied with either two plain or two lever feed tables. Push button control is mounted in the front of the pedestal, in a recess by which it is protected from accidental starting. Cutler-Hammer an

The

ELECTRIC HOIST

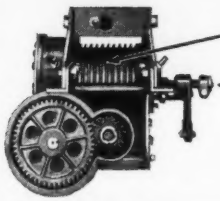
of Unusual Construction and Performance

Steel Plate Suspension

Suspended by means of two heavy steel side plates—eliminating heavy, bulky frame castings. Suits any method of overhead suspension, and makes the "Everedy" Hoist applicable to any type of trolley or support.

Driving Mechanism

Of superior worm and gear type. It is SELF-BRAKING. The worm and gear operate in oil-tight case filled with heavy lubricating oil, insuring longer life and greater efficiency.



Cable Drum

The cable grooves on the drum are machined—not cast. The cable positively will not cross-wind or jump.

Adjustable Automatic Limit Stop

The Reading Limit Stop can be adjusted for any desired distance, either top or bottom. Absolutely safe and reliable.

Write For Complete Information

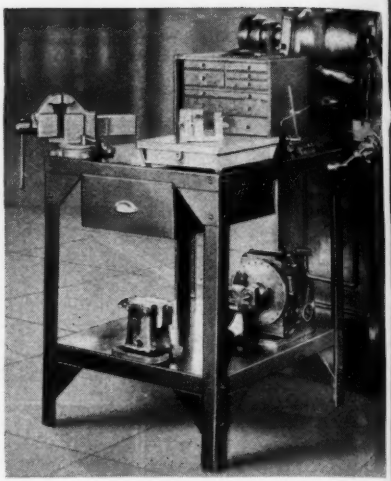
READING CHAIN & BLOCK CORP., READING, PA.

tomatic motor starter with overload protection, low voltage protection, and phase failure protection is standard equipment. The machine can be supplied in sizes from 3 h. p. to 10 h. p., and for discs from 12 in. to 24 in. diameter.

Simplex Service Bench

The Simplex Tool Co., Woonsocket, R. I., has placed on the market a steel bench, shown in the illustration, for use in machine shops, automobile repair shops, and other places where there is need for a small but sturdy work bench. The bench is particularly adaptable for use as a machine tender, to hold the small tools, machine accessories, and so on.

The bench is made of heavy gauge steel, with legs of angle steel and reinforced at the corners and angles with gusset plates. The top surface is 27x27 in., and is 33 inches from the floor. The drawer is 14x20x5 in. deep, with a nickel pull. The shelf, which is 10 in. from the floor, is 26½x26½ inches square. The bench is welded and bolted solidly, and all edges are finished so that no rough edges are presented. It is furnished with or without a machinist's steel slide vise, as preferred. Weight, 82 pounds.

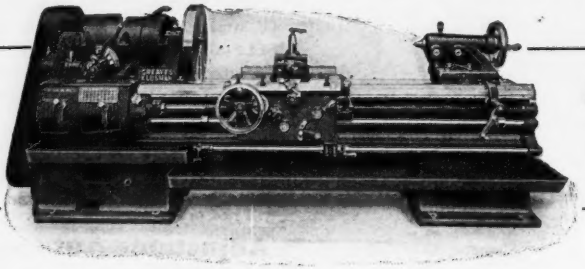


Simplex Service Bench

G.K. SINGLE LEVER CONTROL

MAINTAINS HIGH PRODUCTION SCHEDULES!

Built in Six Sizes



Flexible Motor Drive

TO maintain a high production schedule means that you must eliminate every waste in time, effort and motion.

The G.K. Single Lever Control Lathe eliminates waste in time, effort, and motion, as any speed of an extremely wide range may be instantly selected through only one lever. To eliminate waste still further, a chart tells at a glance how to obtain the desired speed.

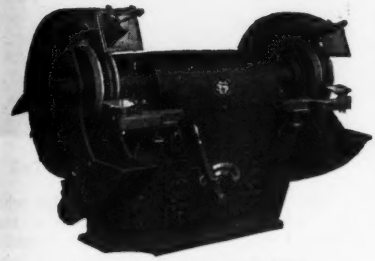
There are many more G.K. Features which eliminate waste and speed up production. Get the whole story, write for a catalog today.

The GREAVES-KLUSMAN TOOL COMPANY

CINCINNATI, OHIO

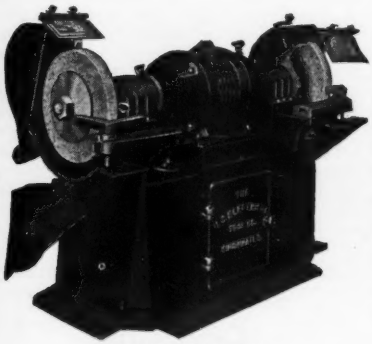
DEPENDABLE

Grinders



A. C. VARIABLE SPEED

For vitrified and high speed snagging wheels. Maintains approximately 9,000 surface feet per minute down to the flanges. (Pat. No. 1,477,052. Other pats. pend.)



HEAVY DUTY

For continuous production service under most severe conditions. Furnished for A. C. or D. C. as desired.

FOR downright dependable and economical performance under severe conditions, records show that U. S. Grinders rank first in many foundries and shops. There's a U. S. for practically every need from portable surface grinders to heavy floor grinders.

BALL BEARINGS

U. S. Grinders are built in accordance with the Safety Code of the American Engineering Standards Committee, Bulletin No. 436, United States Bureau of Labor Statistics. They embody four to six heavy duty SKF Ball Bearings, one-piece chrome manganese alloy steel spindle, powerful motors built to A. I. E. E. standards, etc.

Ask Your Jobber
Or Write Us

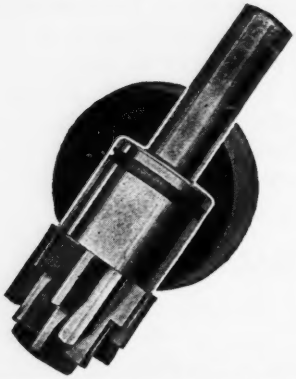
The UNITED STATES ELECTRICAL TOOL CO.

Oldest Builders of Electric Drills and Grinders in the World

2471 WEST SIXTH STREET CINCINNATI, OHIO

Canadian Division—MAPLE LEAF ELECTRICAL TOOLS, Ltd.—TORONTO

Eclipse TOOLS CUT YOUR OPERATING COSTS!



ECLIPSE TOOLS are saving thousands of dollars for their users by eliminating obsolete methods, reducing labor costs, and increasing production.

For example—

The ECLIPSE eight operation cutter illustrated eliminated several operations, one $2,250 machine, five cutters, the labor cost of one man, and cut the former production time in half.

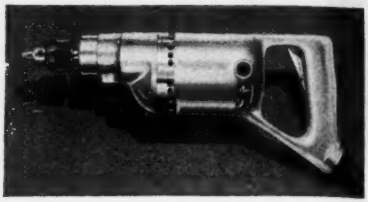
This is just one of the many ECLIPSE High Production Tools which are described in the ECLIPSE Catalog. Send the coupon now for your copy.

ECLIPSE COUNTERBORE CO.
DETROIT MICH.

ECLIPSE COUNTERBORE CO.
7410 St. Aubin Avenue, Detroit, Mich.
Please send your catalog No. 28 to
Name .....
Firm .....
Address .....
City..... State.....

Wappat Portable Electric Drills

Wappat, Incorporated, 7527 Meade St., Pittsburgh, Pa., announces the addition of a line of portable electric drills to



Wappat "Red Streak" Portable Drill

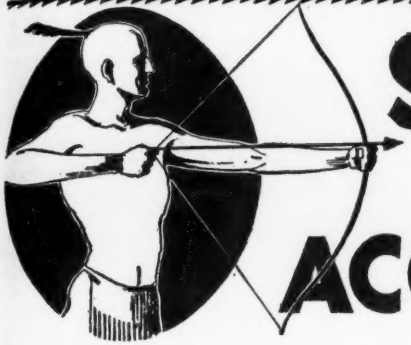
its line of products. These drills, which are being marketed under the trade name of Wappat "Red Streak," make a valuable addition to the line of labor-saving devices that has been manufactured by this company for many years.

The "Red Streak" line of drills includes the ¼-in. standard, ¼-in. heavy duty, ⅜-in. heavy duty, ½-in. heavy duty, and ¾-in. heavy duty sizes. A number of unusual features are found in the design and construction of these tools, including sealed ball bearings on the armature shaft to prevent grease or oil from leaking through to the motor, combination radial and thrust bearings on the spindle, three-conductor rubber covered cable, super-power motor, and unique design in the smaller sizes of drills which enables the user to obtain a firm, comfortable grip without strain of muscles.

Face Mill Grinding Attachment For Cincinnati No. 2 Cutter Grinder

For sharpening quickly and accurately face mills from 8 in. diameter to 20 in. diameter, the face mill grinding attachment shown in the illustration has been developed by The Cincinnati Milling Machine Co., Cincinnati, Ohio. It is built for use with the new No. 2 plain and universal Cincinnati cutter grinders recently announced to the trade.

The attachment consists of three units; the spindle assembly, swivel base, and special arbor. The entire assembly is rigidly constructed to insure perfect sharpening. The work spindle

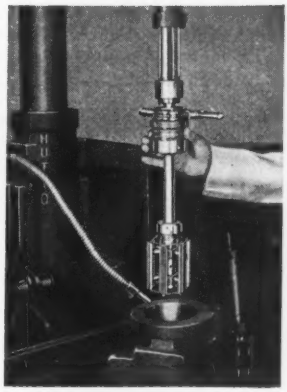


SPEED AND ACCURACY

do not depend on skill of operator when using

HUTTO GRINDERS

HUTTO grinding of cylinder bores is standard practice in 95% of the automobile factories. In 39 other industries cylinder grinding problems are being solved by the Hutto method. Accuracy and finish heretofore considered impossible now easily obtained at low production costs. Cylinders 3/4" to 60" in diameter and of any length can be Hutto ground.



Hutto KKS 9 Grinder

HUTTO

ENGINEERING CO.

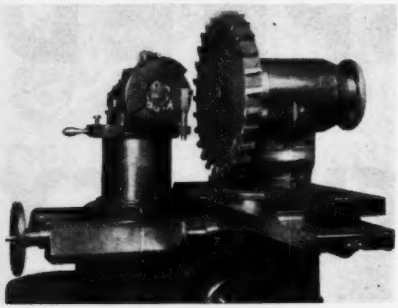
DETROIT MICHIGAN

HUTTO ENGINEERING CO., 515 Lycaste Avenue, Detroit, Michigan
Please Send Us Your General Catalog.

Name.....

Address.....

is mounted on anti-friction bearings front and rear, giving a sensitive and free movement when indexing from one tooth to another. One end of the spin-



Face Mill Grinding Attachment for Cincinnati No. 2 Cutter Grinder

dle is equipped with a knuckled hand wheel, for use in swinging the mill to grinding position. The swivel base is graduated in degrees from 0 to 360, enabling the operator to locate the work in any required position. Provision has been made for locking the spindle after the cutter blade is set in line with the centerline of the grinding wheel spindle, so as to prevent any movement of the cutter while setting up the tooth rest. The distance between the centerline of the attachment and the table is 9½ inches.

Welding Wire Research

The Page Steel & Wire Co., 230 Park Ave., New York, N. Y., has published a book called "Welding Wire Research" which contains a number of interesting facts concerning welding. The book tells why ordinary wire will not do for welding, and discusses the effects of impurities upon the finished weld. It also contains facts concerning the use of the proper type of flame and the correct welding current, and shows how to test welding wire by the heat of the flame. Copies free upon request.

Hisey 5 H.P. Combination Disc and Floor Stand Grinder

The illustration shows the Hisey 5 h. p. combination disc and floor grinder which is being marketed by the Hisey-

No. 409 STOOL
Ten Heights,
18" to 36"

If you appreciate

real construction

consider these specifications:

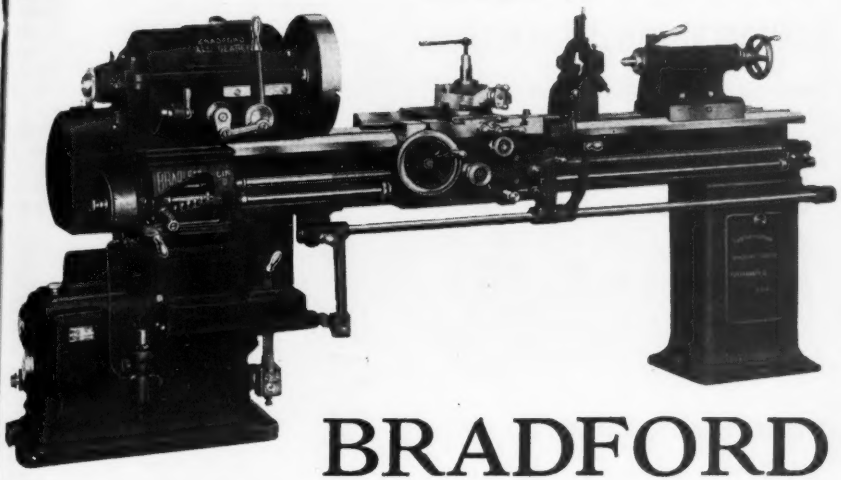
Legs of ⅞" angle steel. Every structural joint double-riveted. Reinforced with welded heavy circular brace.

Truly a stool built for shop abuse.

Write for free trial sample and attractive quotation — types with or without backs. Range 18 to 36 inches high.

Royal Metal Mfg. Co.
1131 S. Michigan Blvd., Chicago, Illinois

In the Tool Room---



BRADFORD QUALITY WINS!

BRADFORD Lathes are made in both all geared motor drive and cone pulley types in sizes from 14" to 50" inclusive for all general manufacturing purposes.

The cardinal requirement of tool room work is accuracy and smooth finish.

And that is where the Quality of the BRADFORD Patented "Lo-Drive" All-Geared Lathe wins. It is a chatterless lathe which produces finishes that show no sign of "gear tooth marks" and accurate results that will meet the most exacting tool room requirements.

BRADFORD Lathes are made with all attachments — taper attachment, universal relieving attachment, draw-in attachment, coarse screw cutting mechanism, etc.

Write for a description of the complete line of BRADFORD Patented "Lo-drive" All Geared Lathes, and a list of the thirty-five *exclusive* BRADFORD Features.

THE BRADFORD MACHINE TOOL CO.

659 EVANS STREET **CINCINNATI, OHIO**

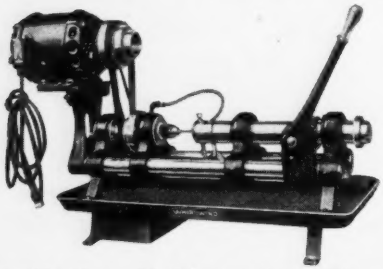
Precision Lathe Builders Since 1840

Whirlwind

HORIZONTAL DRILLING MACHINES

Increase Production—

Lower Cost



Drill *More* Holes in *Less* Time

YOU will be surprised how much faster you can do PRODUCTION Drilling with a WHIRLWIND HORIZONTAL Drilling Machine. Its horizontal construction permits faster loading of parts to be drilled, while the reverse movement of the feed lever AUTOMATICALLY ejects the finished work.

This machine will increase drilling production 50 to 100% over that of a vertical drill press. It is adaptable to practically all small drilling and reduces to the minimum the expense of resharpening and replacing drills. All these facts have been proven in many of the country's largest production shops.

If you'll send us one of your drill problems we'll gladly tell you how many pieces per hour we will guarantee the WHIRLWIND to drill.

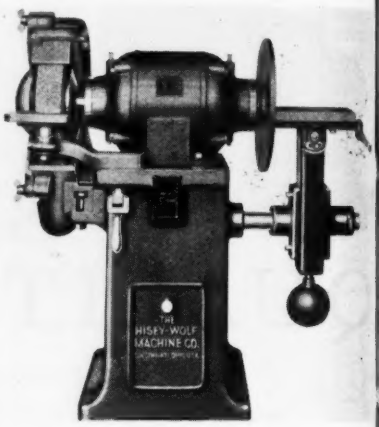
No Obligation, Of Course

WHIRLWIND PRODUCTS CO.

1737 Ludlow Street, Indianapolis, Ind.

Wolf Machine Co., Cincinnati, Ohio. The spindle of this machine is of a special grade of tough steel, and is of extra heavy construction to insure permanent concentricity of the disc. It is mounted on two high grade annular ball bearings, which are subject to thrust loads only. A double-acting, self-aligning thrust bearing is provided to take all end thrust.

The universal lever feed table shown in the illustration is 8x14½ inches. A plain 9½x10½-in. work table can be supplied if desired. The machine is shown equipped with a 20-in. diameter



Hisey 5 H. P. Combination Disc and Floor Stand Grinder

disc wheel and an 18x3-in. grinding wheel. The length of the spindle over all is 42 in., and the base at the bottom is 20x21 in.

Standard equipment includes one full safety combination wheel guard, as shown, 20-in. diameter steel disc, automatic safety motor starter, work table, and connecting wires. Grinding wheel furnished to special order only. The net weight is 1,300 pounds.

Desmond-Rearwin Emery Wheel Dressers

The illustration shows a set of cutters that are used in the Desmond-Rearwin Emery Wheel Dresser, now being marketed by The Desmond-Stephan

(*Continued on page 96*)

EIGHT STEPS TO BETTER DRILLING *SERVICE*

"SUPERIOR"

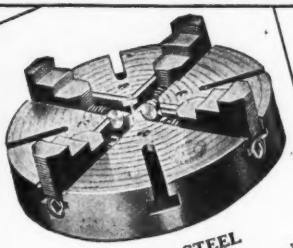
SUPERIOR

Send today for illustrative descriptive literature showing the various types of SUPERIOR UPRIGHT DRILLING AND TAPPING MACHINES.

SUPERIOR MACHINE TOOL CO.

KOKOMO *Since 1902* INDIANA

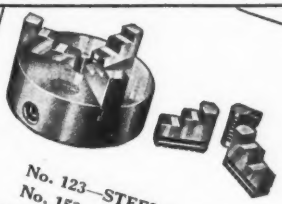
❖ THIS PAIR ALWAYS WINS! ❖



No. 264—STEEL

USE Union All-Steel Independent Chucks where strength to withstand heavy duty performance is required for a modern lathe.

Body of cast steel—three times as strong as iron with extra heavy jaws, made of special steel, with raised ground steps. Large chrome-nickel operating screws have heavy square threads with a bearing on each end. Built in proportion to the strength of shell.



No. 123—STEEL BODY
No. 153—IRON BODY

SHOP MEN prefer a strong one-piece shell as used on UNION Geared Scroll Chucks because they will not break under sudden strains.

Jaws, scroll, and pinion are made of Alloy steel and hardened. Jaws are ground true and tested for accuracy.

Reversible top jaws also furnished if desired.

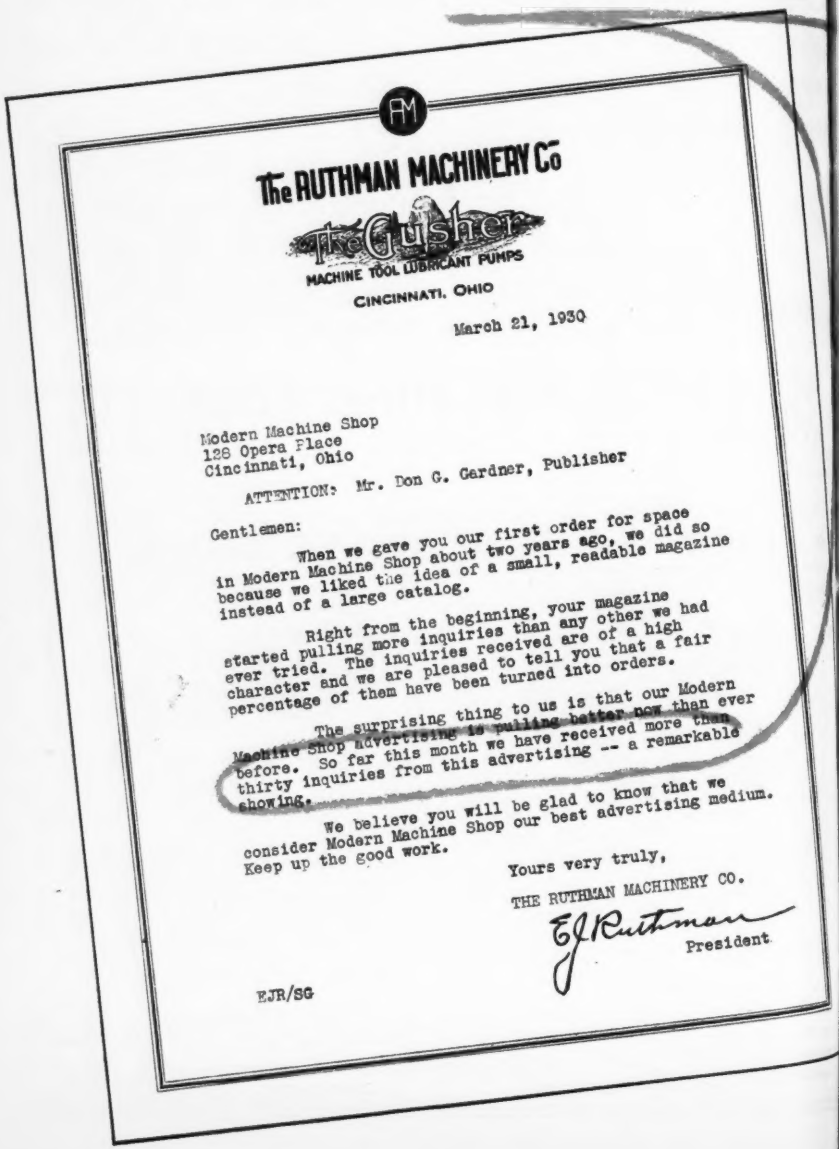
Ask Your Dealer or Write Us For Catalog.

New York Chicago Cleveland

UNION MFG. CO.
NEW BRITAIN CONNECTICUT

Cincinnati San Francisco

"Thirty Inquiries Received up



The RUTHMAN MACHINERY Co

The Gusher

MACHINE TOOL LUBRICANT PUMPS

CINCINNATI, OHIO

March 21, 1930

Modern Machine Shop
128 Opera Place
Cincinnati, Ohio

ATTENTION: Mr. Don G. Gardner, Publisher

Gentlemen:

When we gave you our first order for space in Modern Machine Shop about two years ago, we did so because we liked the idea of a small, readable magazine instead of a large catalog.

Right from the beginning, your magazine started pulling more inquiries than any other we had ever tried. The inquiries received are of a high character and we are pleased to tell you that a fair percentage of them have been turned into orders.

The surprising thing to us is that our Modern Machine Shop advertising is pulling better now than ever before. So far this month we have received more than thirty inquiries from this advertising -- a remarkable showing.

We believe you will be glad to know that we consider Modern Machine Shop our best advertising medium. Keep up the good work.

Yours very truly,

THE RUTHMAN MACHINERY CO.

E J Ruthman

President

EJR/SG

e Twenty-First of the Month"

Says the Ruthman Machinery Company, Cincinnati, Ohio—manufacturers of the Ruthman line of "Gusher" Pumps.

Reproduction of their letter on the opposite page tells its own story.

With the May issue the circulation of MODERN MACHINE SHOP—hand picked—will reach the high water mark of nearly 28,000 copies.

If you want results; if you want to place your sales message before several thousand more plants operating machine shops than can be reached by any other magazine, place your order for space in MODERN MACHINE SHOP.

Send us your advertising copy instructions now for the May issue. Forms close Saturday, April twenty-sixth.

Modern Machine Shop Advertising Rates

	1 PAGE	½ PAGE	¼ PAGE	⅛ PAGE
12 months	$100.00	$55.00	$30.00	$16.25
6 months	110.00	60.00	32.50	17.50
3 months	120.00	65.00	35.00	19.00
1 month	130.00	70.00	38.00	22.50

MODERN Machine Shop

128 OPERA PLACE CINCINNATI, OHIO

CONNECTICUT BROACHES

Combine Operations!

Combining operations always results in time savings and lower costs. The Connecticut combination round and spline broach obtains these results by broaching the drilled hole to size, cutting the splines, and removing the burr *in one operation*. Besides, the accuracy of the job is improved.

Investigate the possibilities of these tools in your plant. Send us a description of your job and let our engineers recommend a broach that will be guaranteed to do your job better!

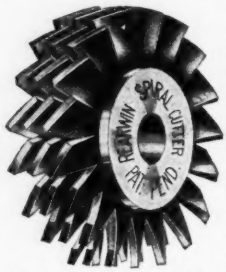
***The* CONNECTICUT BROACH & MACHINE CO.**

NEW LONDON, CONN.

New Shop Equipment

(*Continued from page 92*)

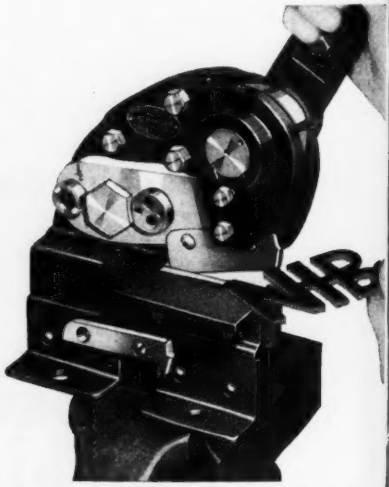
Mfg. Co., Urbana, Ohio. The dresser is made with a well-shaped, strong handle, and the cutters are of special spiral design which leaves the face of the grinding wheel straight and smooth. The cutters are of a high grade of steel, twisted and tempered, and are self-sharpening. The dresser is made in two sizes, the No. 1 with three cutters to a set, and the No. 2 with six cutters. All cutters are 1¾ in. in diameter and fit a ¼-in. pin.



Cutters for Desmond-Rearwin Emery Wheel Dresser

National No. 4 H. D. Handnib

The National Machine Tool Co., 1542 Clark St., Racine, Wis., announces the addition of a heavy duty model to its

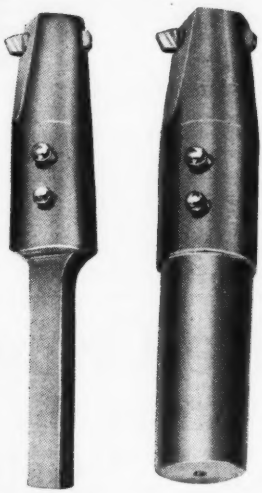


National No. 4 Heavy Duty Handnib

line of "Handnib" tools. The new tool, Model No. 4, will shear or nibble ⅛-in. flat stock to any shape desired. It take

NEW

THE WEDGE-LOCK BORING TOOL



FOR ENGINE OR TURRET LATHES

BUILT FOR BORING

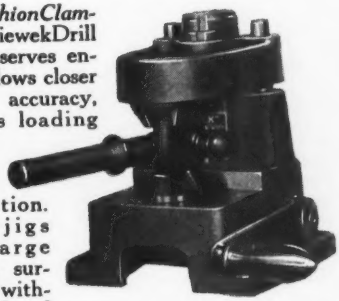
Sold by Jobbers Everywhere

CIRCULAR UPON REQUEST

WEDGE-LOCK TOOL CO.

2523 N. Keeler Ave. CHICAGO

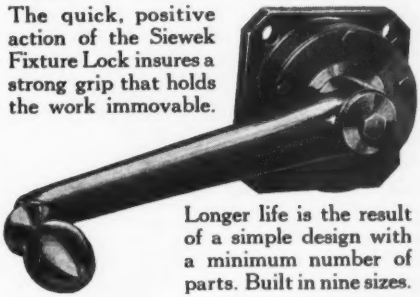
Siewek Drill Jigs



The *Cushion Clamping* of Siewek Drill Jigs conserves energy, allows closer drilling accuracy, reduces loading time, and increases production. These jigs have large wearing surfaces to withstand hard usage and to maintain their accuracy. It is built in eight types.

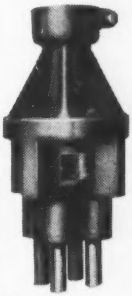
Siewek Fixture Locks

The quick, positive action of the Siewek Fixture Lock insures a strong grip that holds the work immovable.



Longer life is the result of a simple design with a minimum number of parts. Built in nine sizes.

Siewek Drill Heads



Siewek Drill Heads, when used in combination with Siewek Drill Jigs, insure a tool set-up that will give maximum production over a long period of time. There is a Siewek Drill Head to meet every requirement.

WRITE FOR CATALOG

Siewek Tool Co.

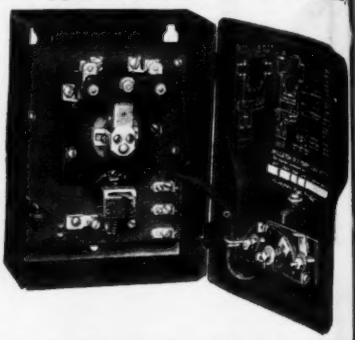
10232 Woodward Ave., Detroit, Mich.

care of inside nibbling of various designs in sheet metal of the same capacity, and will cut drill rod, cold rolled steel, or any round stock of $\frac{5}{16}$, $\frac{1}{4}$, $\frac{7}{32}$, $\frac{3}{8}$, or $\frac{1}{2}$-in. diameter.

The Model No. 4 is especially adapted for nibbling out trial blanks or sample forms, or for making up any kind of template. It is also very handy for experimental work in sheet metal, having capacity for any kind of stock up to $\frac{3}{16}$ in. in thickness. Blades for inside and outside nibbling may be interchanged by the removal of two small screws. The body of the tool is made of cast steel, and all wearing parts are hardened and ground. The double crank action of this tool makes it possible to nibble stock within the capacity of the tool with ease.

Allen-Bradley Starting Switch For Single Phase Motors

The Allen-Bradley Co., 288 Greenfield Ave., Milwaukee, Wis., announces the Bulletin 707 Single Phase Starting Switch for motors used to operate air compressors, pumps, or other motor-driven devices that are governed by either two-wire or three-wire contro The switch is of the double-pole mag netic type with thermal overload relay



Allen-Bradley Starting Switch for Single Phase Motors

and has a maximum rating of 1½ h. p 110 volts, and 3 h. p., 220 volts.

A unique feature of this switch is th operating coil, which has a doubl winding for series-parallel connection permitting the switch to be used inter changeably up to and including 1½ h. p for 110 or 220-volt motors by simply

Nielsen Live Centers Stand the "Gaff"!

THE stamina of NIELSEN Live Centers has been proven in a recent demonstration of tungsten carbide cutting tools at the Case School of Applied Science.

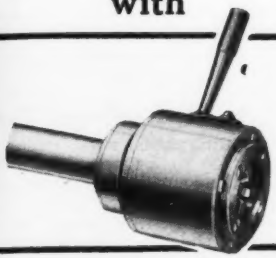
A standard No. 6 NIELSEN Live Center was placed on a turret lathe equipped with a tungsten carbide cutting tool. A cut ⅝" deep with a feed of .037" per revolution was taken in cast iron at a cutting speed of 500 surface feet per minute.

Next steel with an analysis of .50 carbon, .75 chrome and 1½% nickel was turned. A cut ¼" deep with .037 feed per revolution was taken at a cutting speed of 200 feet per minute. The center stood up under this cutting load without chatter and showed no sign of breaking down or burning.

There is NIELSEN Live Center for every center requirement — write for bulletin

NIELSEN, INC.
LAWTON, MICHIGAN

Solve Your Threading Problems with



MURCHEY TOOLS!

OBTAINING perfect threads with an accurate lead in large production lots is always a hard problem to solve with ordinary chasers.

But not so with MURCHEY Tools and Chasers — that's when they prove their efficiency! They enable the fastest equipment to turn out accurate work at top speeds.

One of the most popular MURCHEY Tools for turning out perfect threads is the type "G" self-opening die head. It is ideally suited for use on stationary single spindle automatic threading machines, as it is instantaneous in action, small in diameter, and a precision tool in every sense of the word.

This MURCHEY Tool — or any other—will be sent on approval. Just send us a blue-print of your particular job and we'll select a tool most suited for your work.

WRITE FOR CATALOG

MURCHEY
MACHINE & TOOL CO.
951 PORTER STREET
DETROIT MICHIGAN

and the Die Making Industry Said "Yes"!

Made in two sizes, capacity 1,500 and 3,000 pounds respectively.

"Click!" From the instant we announced the new Davenport Universal Die Holding Stand, it clicked. Die makers were quick to appreciate that here was a simple, inexpensive way to save space and achieve quick, easy die block handling.

Two men can now work comfortably where one worked before. The capacity per man is greatly increased because the awkward work bench and the tugging and straining needed for shifting the die block is eliminated. With a Davenport Universal Die Holding Stand the block is changed to any desired position instantly and with "finger tip ease."

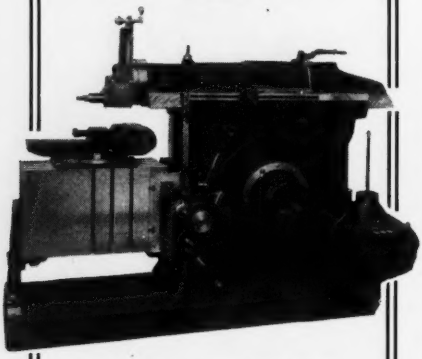
No die shop can be classed as strictly modern until equipped with this new improvement. By the test of profits you cannot afford to *not* install Davenport Universals. Try one and you'll want more.

Davenport Locomotive & Mfg. Corp., Davenport, Iowa
Sold Exclusively Through
The Wesson Sales Co., 7338 Woodward Avenue, Detroit
Representatives in All Larger Cities

DAVENPORT
▶ Universal ◀
Die Holding Stand

Davenport 1090

Columbia
SUPERIOR



SIMPLIFY YOUR SHAPING PROBLEMS with

Columbia Shapers

THERE are many features of the COLUMBIA "Superior" SHAPERS which simplify your shaping operations, increase accuracy, reduce time, labor, and tool costs.

One of these features, in particular, is the table. Note, for example, how it extends well beyond the massive column, utilizing the full length of stroke and affording ample room for proper setting of the work.

Another is the column. Observe how massively it is constructed. How firm and solid it supports the other members. Note the heavy arch type ram. These factors eliminate vibration and improve the accuracy of the work.

These are just three COLUMBIA features which simplify your shaping problems. Bulletin 17 will give you the rest. Write for it—today!

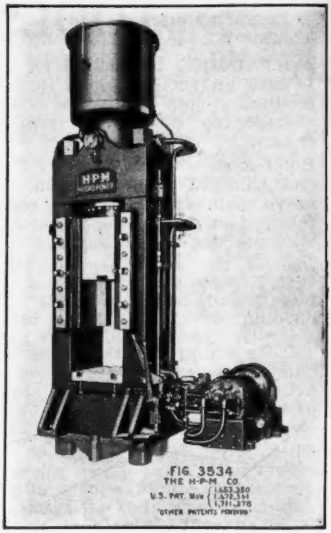
THE COLUMBIA MACHINE TOOL COMPANY

HAMILTON, OHIO

changing the terminal connections of the operating coil. This innovation increases the flexibility of the switch and reduces the number of switches required to be carried in stock to meet normal requirements. It can be furnished with start and stop push buttons in the cover, without push buttons, or with two-way lever switch.

H-P-M Hydro-Power Press

A hydraulic press with which pressure from 150 to 2,000 tons can be obtained has been placed on the market by The Hydraulic Press Manufacturing Co., Mount Gilead, Ohio. The press, known as the H-P-M Hydro-Power Press, is a complete, self-contained unit occupying a minimum of floor space for a press of this type. No hydraulic

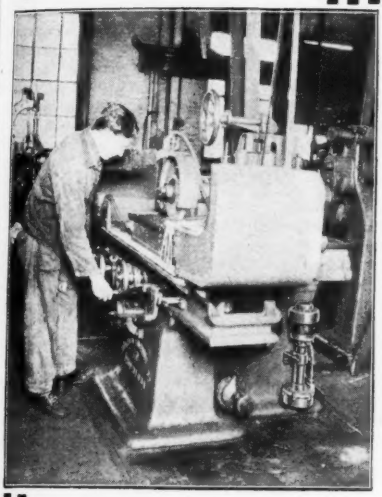


H-P-M Hydro-Power Press

accumulator system, compressed air, or other outside source of pressure is required to operate the machine.

The fact that oil is used as a pressure medium makes it possible to eliminate all valve and pump packings, ground joints being used instead. The possibility of leakage is eliminated by the use of high grade seamless tubing with forged fittings, every joint being

VOLUME OF COOLANT DOES IT!



A spinning emery wheel . . . a piece of hardened steel . . . friction . . . and frictional *heat!* That's the story of your grinder.

You need *volume* of coolant to carry away such a tremendous amount of heat and to maintain an evenly moderate temperature at the cutting surface. The coolant must not only *flow,* it must *gush!* And it will *gush* if it is being pumped with a

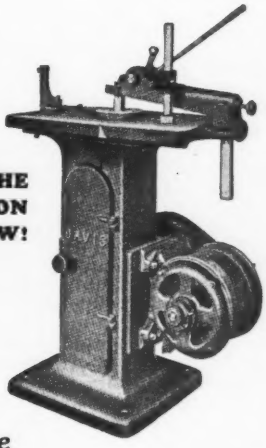
GUSHER Coolant Pump

Send for our 1930 catalog—just out!

THE RUTHMAN MACHINERY CO.
532 East Front St. Cincinnati, Ohio

Have You Investigated

MAIL THE COUPON NOW!



The Davis Keyseater

WHILE the Davis Keyseater can be profitably employed on quantity production for a standard part, two minutes is all the time required to change over for each item of a run of mixed work. Its capacity is from 1/16 inch to 1 inch, and cuts tapered or straight Keyways with equal efficiency.

The Davis "Two-Minute-Set-Up" means maximum production. Investigate this method now!

DAVIS KEYSEATER CO.
250 MILL STREET, ROCHESTER, N. Y.

I am interested in the Davis Keyseater. Send me Complete Catalog

Name..... Title.....

Firm.....

Address.....

.....

M.M S. 4

electrically welded. The piping is designed to carry pressures up to 10,000 lb. per sq. in.

High speed automatic operation of the press may be achieved through the use of specially developed hydraulic control mechanisms, which can be set for either automatic or semi-automatic operation. When set for the semi-automatic cycle, the tripping of the starting lever starts the platen downward at fast speed; as the platen approaches the work, it slows to a slower full load rate and as soon as the pressure is built up to a predetermined limit, it automatically shifts into fast speed again. The platen then returns to the starting position and stops. The full automatic cycle is the same as the semi-automatic except that, when once started, the press will repeat the cycle automatically, reversing at both ends of the stroke until stopped. In either case, the press can be stopped at any point in its operation instantly.

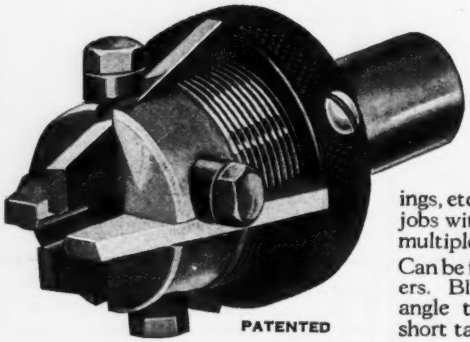
The press is especially adapted for the production of both shallow stampings and deep drawn parts, due to the fact that the variable working stroke can be adjusted to suit the particular requirements of each job. The Hydro-Power Press is made ready by simply adjusting the length of the stroke, setting the dies, and setting for the desired pressure. There is no limitation to a fixed stroke or the height of the dies, within the limits of the machine. The exact total pressure applied to the work is indicated by a direct-reading pressure gauge. Full pressure may be developed at any point along the stroke, as required, but the press cannot be overloaded while in operation, even by the accidental insertion of extra stock.

"Duromit" Flooring

A recent development in a flooring material, which has met with great success in European countries, is now being introduced in America by Duromit Floors, Inc., 27 E. Water St., Cincinnati, Ohio. Machine shop executives will be especially interested in the fact that this flooring material will not check or pit out under the heaviest kind of traffic. Neither will it absorb oil or grease consequently it will not disintegrate from absorption or from water seepage. This flooring material, when colored, rubbed down and polished, makes a long wearing substitute for terrazo tile for

Genesee Adjustable Hollow Mill

Made in 7 different styles



PATENTED

Has adjustable, replaceable blades and can be replaced at nominal cost, making it unnecessary to continually buy new tools.

The ideal tool for finishing your forgings, castings, etc. Do your several operation jobs with Genesee inserted blades multiple operation tools.

Can be fitted with drills and reamers. Blades can be ground any angle to point work and turn short tapers.

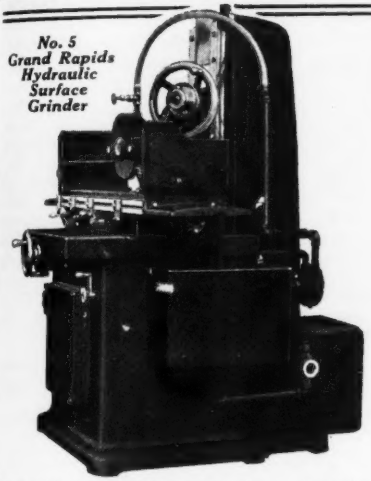
A Genesee Adjustable Hollow Mill can be made for every job

WRITE FOR CATALOGUE

GENESEE MANUFACTURING CO., Inc.

ROCHESTER, NEW YORK

SMOOTHER FINISHES
—with—
GRAND RAPIDS
OIL GEAR HYDRAULIC FEED
SURFACE GRINDERS


No. 5 Grand Rapids Hydraulic Surface Grinder

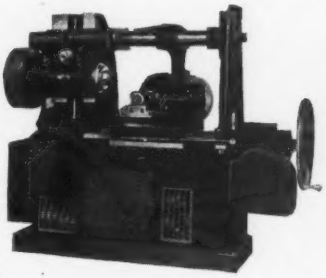
GRAND RAPIDS Surface Grinders provide a better means of producing the extremely accurate and smooth finishes demanded by modern manufacturing methods. They are equipped with Oilgear hydraulic feed which assures mirror-like surfaces so desirable on surface grinding jobs.

The hydraulic feed also provides any feed up to fifty-five feet per minute by simply turning the handle on the front of the base. The Oilgear mechanism also actuates the cross feed, which can be set to operate at each end of the stroke, or at one end only.

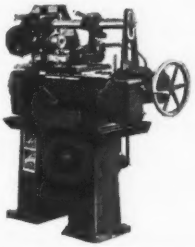
GRAND RAPIDS Surface Grinders are built in four sizes, arranged for either wet or dry grinding, with motor or belt drive. *Send for circular!*

GALLMEYER & LIVINGSTON CO.
348 Straight Ave., S. W.
GRAND RAPIDS, MICH.

SERVICE *Is Our Motto* QUALITY *Our Creed*

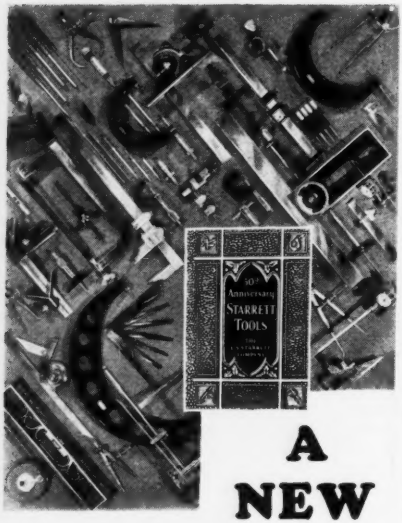


HOBBING MACHINES
by
BARBER-COLMAN
of ROCKFORD



4 SIZES of Hobbing Machines . . . two sizes "universal" type for spur and spiral gears, sprockets, ratchets, splined shafts and other hobbed forms . . . two sizes for high production on spur gears and splined shafts only . . . Quality Products . . . Send for our circulars.

BARBER-COLMAN COMPANY
General Offices and Plant, *Rockford, Ill., U.S.A.*



A NEW CATALOG

PUT the NEW Starrett Catalog in your kit. Old familiar tools, improved tools, new tools — you'll find over 2,500 of them in the latest Starrett Catalog No. 25 "MD" just out. Tear out the coupon . . . mail it today.

50th Anniversary of Starrett Tools, 1880-1930

Use Starrett Tools

THE L. S. STARRETT CO.
Athol, Massachusetts.

Gentlemen: Please send me my free copy of Starrett Catalog No. 25 "MD." My occupation is (please check one): Machinist ( ); Toolmaker ( ); Diemaker ( ); Executive ( ).

Name .....

Address .....

.....

3508

lavatories, lobbies, showrooms, and safety tread stairs. The material is known by the trade name of "Duromit" and is a concrete, its only aggregate being synthetic crystals which are mixed with cement and water.

Schauer "Ideal" Speed Lathe

To meet the demand for a tool in which small parts can be held while they are being finished or polished, the Schauer Machine Company, 903 Broadway, Cincinnati, Ohio, has developed the speed lathe shown in the illustration. The construction of the lathe embodies a two-speed, totally enclosed, dust-proof motor, automatic brake, ball bearings, extension in motor spindle to take extra long rod stock, and 4-in. chuck. High or low speeds are selected by means of a speed-control switch in the motor base. The current is cut in by a slight backward push on the hand lever, a forward movement of the lever cutting off the current and applying the brake simultaneously.

The brake is of unique design, operating against a large-diameter extended

Schauer "Ideal" Speed Lathe.

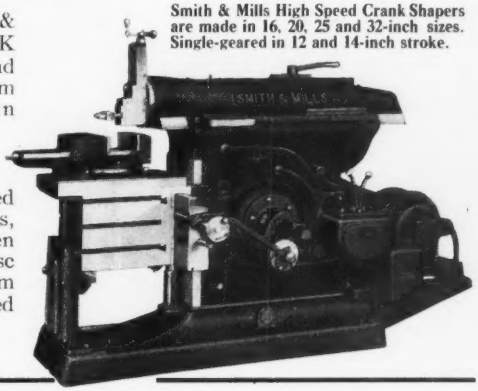
surface of the motor spindle. The brake action is positive, but smooth and gradual, although it will stop the motor in three seconds when running in high speed or one and one-half seconds at low speed. Means are provided for regulating the brake pressure and adjusting for wear of the brake shoe. The motor is ½ h. p., two-speed design to

DEPENDABLE SHAPERS

THE dependability of SMITH & MILLS High Speed CRANK SHAPERS to improve results and increase production has made them the choice of production men throughout the industry.

Modern Improvements included in the design of these tools, such as "V" type ram with 55 degree ways, splined shafts, heat-treated alloy steel gears, speed box shafts mounted on Timken Tapered Roller Bearings, Twin Disc Clutch and one shot lubrication system make SMITH & MILLS High Speed CRANK SHAPERS real producers.

WRITE FOR CATALOG.

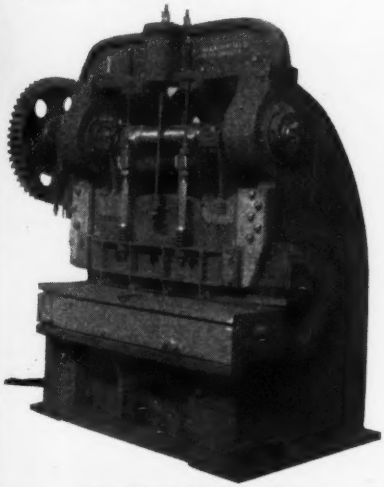


Smith & Mills High Speed Crank Shapers are made in 16, 20, 25 and 32-inch sizes. Single-geared in 12 and 14-inch stroke.

THE SMITH & MILLS CO.

CINCINNATI, OHIO

EFFICIENCY—DEPENDABILITY



Gate Shear, Medium Size

Both Prime Factors Built in

POWER PUNCHING and SHEARING

Machinery Made By

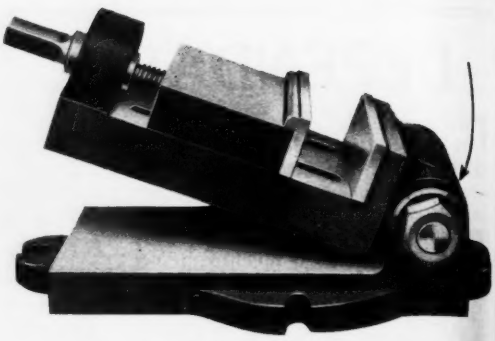
THE LONG & ALLSTATTER CO.

HAMILTON, OHIO

A superior and more complete line than ever, for perforating and cutting off metal in practically any size or shape

STEEL PRESS BRAKES
ALLIGATOR SHEARS
POWER PRESSES

provide 2,700 r. p. m. and 1,350 r. p. m. on direct current, or 3,400 r. p. m. and 1,700 r. p. m. on alternating current. It is totally enclosed, dust proof, and will operate continuously without overheating. A hollow spindle within the motor permits insertion of 1-in. rod or tube stock 9 in. long from the face of the chuck, thus making it possible to finish 12 to 16-in. rods without the necessity of an end support.



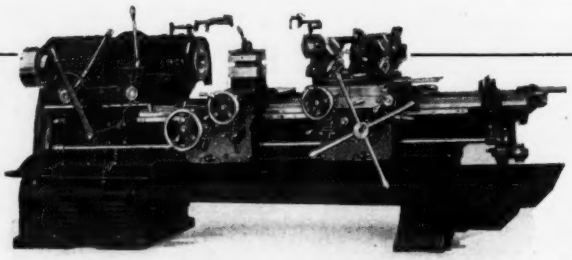
Palmgren Universal Vise

Palmgren Universal Vise

A machine vise with the base and body hinged together so that the base can be bolted to the table of the machine while the body is tilted at an angle has been developed by the Chicago Tool and Engineering Company, Eighty-fourth Street and South Chicago Avenue, Chicago, Ill. The body is held in position by a special bolt joint, which is guaranteed not to slip. The vise jaws are hardened and ground, and the bolt and screw are of heat-treated alloy steel. Graduations are provided so that settings can be duplicated without difficulty, and extra lugs are provided for bolting down. Every detail of the vise has been planned for rigidity and long wear. The vise is suitable for either production or tool work.

STURDY CONSTRUCTION and NEW DESIGN

No. 1 or No. 2



Semi or Full Universal

THE sturdy, heavy construction and the new design of the No. 1 and No. 2 Acme Universal Turret Lathes offers big machine rigidity with small machine ease of control and flexibility.

The new design features anti-friction bearing feed and speed transmission—superior mounted roller bearing spindle — splined shafts — hardened and heat-treated alloy steel gears.

WRITE FOR NEW BULLETINS

THE ACME MACHINE TOOL CO., 4955 Spring Grove Ave., Cincinnati, O.

Here's low cost grinding for you!

THIS handy, inexpensive grinder will save time on many small grinding jobs and pay you big dividends. It is ideal for removing burrs from castings; for grinding manifolds, cutlery, tools, die castings, stampings and countless other jobs. Extremely accurate. Faster than a wheel, gives a better finish than a disc.

No circular scratches—just a smooth, even, flat finish. This Type B-2 Porter-Cable Grinder can be changed from horizontal to vertical in only 3 minutes—two machines at the cost of one. Also, a larger type, as well as Disc and Spindle Sanders and Grinders.

Send us your rough and finished samples and we'll tell you what production you can obtain. No obligation—write now.

The Porter-Cable Machine Co.

Machine Tool Builders for 24 Years

300 WOLF STREET SYRACUSE, N. Y.

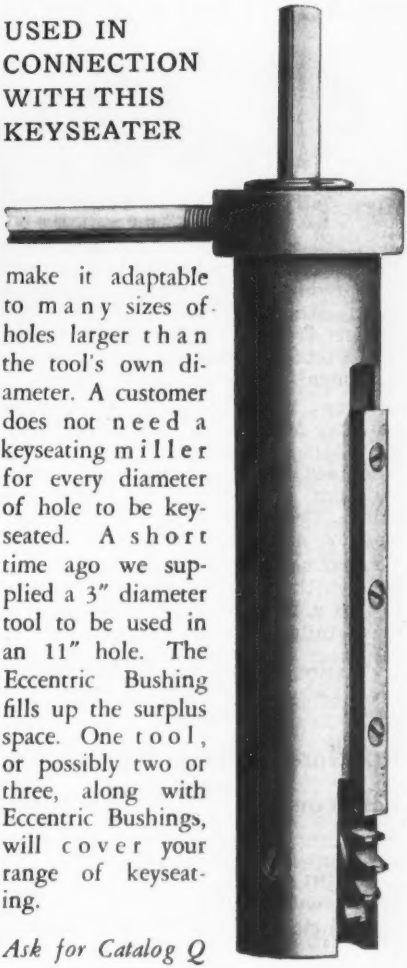
PORTER–CABLE

GRINDERS

3614

ECCENTRIC BUSHINGS

USED IN CONNECTION WITH THIS KEYSEATER



make it adaptable to many sizes of holes larger than the tool's own diameter. A customer does not need a keyseating miller for every diameter of hole to be keyseated. A short time ago we supplied a 3" diameter tool to be used in an 11" hole. The Eccentric Bushing fills up the surplus space. One tool, or possibly two or three, along with Eccentric Bushings, will cover your range of keyseating.

Ask for Catalog Q

National Machine Tool Co.

2271 Spring Grove Avenue

CINCINNATI, OHIO, U. S. A.

The PULLMORE Industrial Clutch

is dependable

PULLING heavy loads—year in and year out—with a minimum number of adjustments, is the kind of service you get from the PULLMORE Industrial Clutch, accounting for its use on prominent equipment as follows:

Leading manufacturers of Lathes, Laundry Machinery, Drilling and Boring Machines, Snow Plows, Milling Machines, Testing Machines, Fire Fighting Equipment, Grinding Machines, Cranes, Rubber Working Machinery, and many others.

You can solve your transmission problems with the PULLMORE Clutch. Let us show you how. Just send us the details of your requirements.

Be sure you get the PULLMORE Catalog—send the coupon TODAY!

Rockford Drilling Machine Co.
10 Catherine Street
ROCKFORD ILLINOIS

ROCKFORD DRILLING MACHINE CO.
Rockford, Ill.
Send me a copy of the PULLMORE Industrial Clutch Catalog.
Name..... Title.....
Firm .....
Address .....
City .....State.....
MMS-4

Bohnalite Housings for U. S. Drills

Bohnalite housings are now being used on the ¼, 5/16, and ⅜-in. portable electric drills made by the United States Electrical Tool Co., 2471 West Sixth St., Cincinnati, Ohio. Bohnalite is also being used for the housings of the Nos. 1 and 2 sizes of screw drivers, valve

U. S. Electrical Drill with Bohnalite Housing

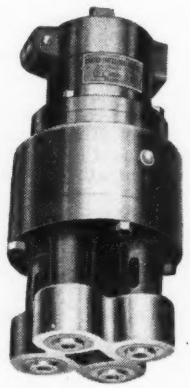
grinders, and tappers. As this metal is a particularly tough alloy, these tools will stand up better and longer under rough handling and hard service than has been possible heretofore.

The new designs of the ¼, 5/16, and ⅜-in. Special U. S. drills permit the removal of one side of the handle and housing end in one piece, thus making the switch, wiring and commutator more easily accessible when servicing is necessary. The brushes also can be more quickly removed and replaced. The new lines of the handle permit a better grip without increased strain, and appreciably increase the appearance of the tool.

Machining Wright Engine Parts

(*Continued from page 64*)

pulls the mandrels tightly into their bearings. The cutters revolve at a rate of 63 r. p. m. and remove from ⅛ to 3/16 in. of stock while feeding at a rate of 1¾ in. per minute. A production of 61 pieces per hour is obtained with this equipment.



Multiple Units

From Single Drills

Designed to fit any type of drill press, a U. S. Drill Head converts any single spindle drill into a multiple unit quickly.

No time wasted making adjustments—spindles are fixed. Any number of holes, fifty if necessary, can be drilled as easily as one.

We will design a U. S. Multiple Drill Head to meet your individual requirements. Tell us your needs. Address

The United States Drill Head Co.

1954 Riverside Drive

Cincinnati, O., U. S. A.

Exchange your old cutters for new ones!

"Say, Jim, how would you like to exchange these old worn out cutters for new ones? You can, by merely having them reclaimed by the National Tool Salvage method. Besides getting a cutter that is as good as new, you can reduce your tool costs 20% to 60%. You can't beat that."

"No, John, I don't suppose I can beat that, but will they be as good as new tools?"

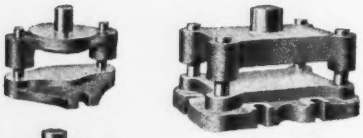
"Sure they will, Jim. The teeth are recut and the clearance restored by this method without impairing the quality or temper of the steel. Each recut tool is guaranteed the same as any new tool."

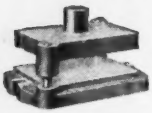
Jim was a bit skeptical, but a trial convinced him. A trial will also convince you of the economy of this method. Send us a few of your worn out cutters. Let us recut them and then test the reclaimed cutter on your own work. You won't be disappointed!

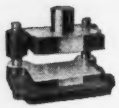
National Tool Salvage Co.

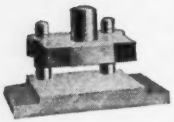
3840 Beaubien St. **Detroit, Mich.**

PRODUCTO READY-MADE *DIE SETS*









Thousands of leading plants select their die sets from the 28 different styles and 200 combinations of sizes of Producto "READY-MADES"—stocked for overnight delivery at Bridgeport, Conn., and Detroit, Mich.

Producto "READY-MADE" Die Sets save time in the drafting room, in the pattern shop, and in fact all along the line. Each set is carefully inspected before leaving the factory to assure you real service.

Be sure you get a copy of Catalog No. 5. It contains 38 pages of valuable information for designers and builders of tools. Send the coupon today!

The PRODUCTO MACHINE Co.

BRIDGEPORT CONNECTICUT

Branch Factory Stock:

1900 E. Jefferson Ave., DETROIT, MICHIGAN

The Producto Machine Co., Bridgeport, Conn.
Send me a copy of the Producto Catalog No. 5.

Name..... Title.....

Firm.....

Address.....

City..... State.....

Cincinnati Miller and Grinder Catalog

The Cincinnati Milling Machine Company and Cincinnati Grinders, Inc., Cincinnati, Ohio, have co-operated in publishing a 52-page catalog covering the standard lines of machine tools manufactured by both companies. Illustrations, descriptions and specifications of Knee and Column Type, Automatic and Hydromatic Millers, and Cutter Grinders are included by the Cincinnati Milling Machine Company, and similar typography and makeup shows the Centerless and Centertype Grinders built by Cincinnati Grinders, Inc. In addition to the descriptions and specifications in English, this booklet also contains French and German dimensions and descriptions.

Producto Die Sets

The Producto Machine Company, 99 Housatonic Avenue, Bridgeport, Conn., has added eight new styles to the line of die sets manufactured by this firm for the mounting of punches and dies on power presses, dieing machines and high-speed blanking presses. The sets are available in either semi-steel or steel castings, or they may be obtained in a chrome-nickel iron mixture having from 40 to 50 per cent of steel scrap, or in the form of hammered steel forgings. In Fig. 1 is shown the Style 130 round die set, which is useful on power presses where the shut height is limited or where the working surface on the bolster plate is small. The clamping surface is finished on the whole circumference of the die shoe, a feature which permits easy clamping in any position. While ordinarily these sets are furnished with pins having eccentric grooves, they can also be supplied with pins having spiral grooves at slightly additional cost. This die set is manufactured in six sizes, the die-working surface diameters ranging from 4 to 12 inches.

The Style 146 round die set, Fig. 2, meets with ordinary requirements for making round stampings. Dies can easily be mounted on the round pads; pins are in the rear, out of the way, and support the punch holder. This set is made in eight sizes. Square punch holders instead of round can be furnished with this set if desired.

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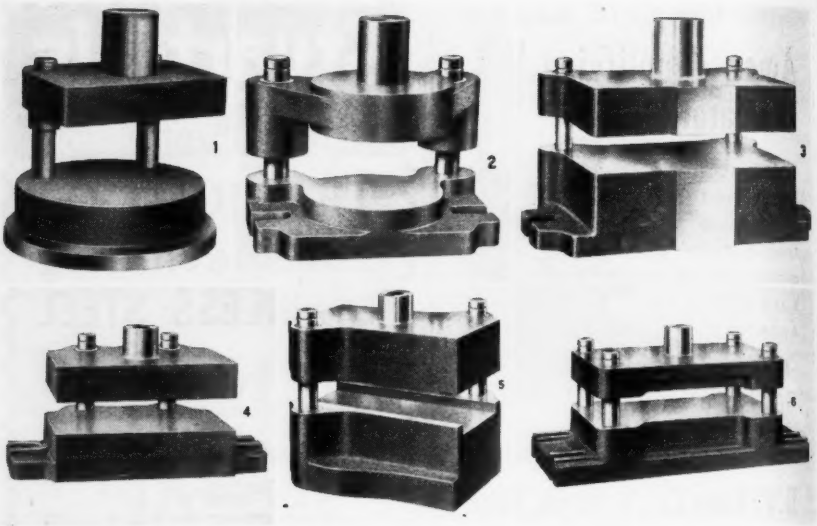

Fig. 1—Style 130 Producto Round Die Set, for use on presses where the shut height is limited. Fig. 2—Style 146 Die Set, for making round stampings. Fig. 3—Styles 141 and 149, of the general type shown, are of the overhanging type to take extra large widths. Fig. 4—These sets are for Henry & Wright Dieing Machines. Style 176 is made in 6 and 9-in. widths. Fig 5—Style 177 has an extra large working surface. Fig. 6—Style 178 is a universal type for use on 25 and 50-ton machines.

The Style 147 round die set is similar to the Style 146 except that the pins are placed on the center line and also that it can be used for passing strips of metal between the pins, where the pins set directly in front of the operator. It can be used also with the open sides to the operator for cupping, piercing, or other similar operations. This set is made in eight different sizes. Overhanging die sets are made in Styles 141 and 149, which vary only in the thickness of the punch and die holders. A set is illustrated in Fig. 3. It has been designed to take metal of extra width and is known as an overhang set because of the longer dimension from the front to the rear as compared with the distance from left to right.

In Figs. 4, 5 and 6 are shown standard die sets for use on Henry & Wright dieing machines. These sets have been so designed that they can be passed between the guide rods of the machine without removing the head. Other types

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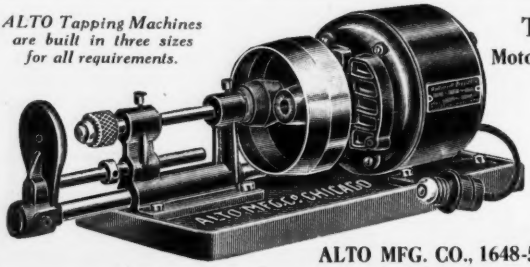

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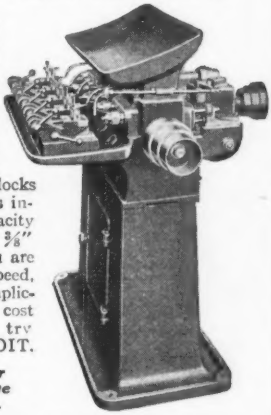

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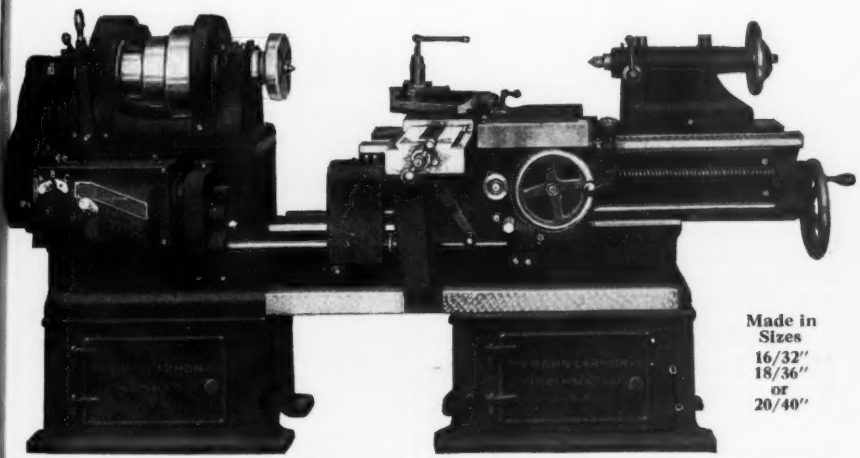

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are also manufactured for providing extra large working surfaces, although with these types it is necessary to remove the head of the machine to mount the complete set on the bolster.

The Style 176 die set illustrated in Fig. 4 has two guide pins in the rear, and the distance between the pins has been gauged to allow the set to slide in on the bolster plate of the machine and between the guide rods without interference. It is made in widths of 6 and 9 inches. The Style 177 die set has two pins on diagonal corners and is made for 25 and 50-ton machines. It allows for a large working surface and at the same time provides for easy mounting between the guide rods. It is made in 9¾ and 16-in. widths. Style 178 has four pins and is also made for 25 and 50-ton machines. The eight styles include a large range of sizes.

Back Shop Work

(*Continued from page 26*)

by which it is also adjusted to fit the size of pipe in process. A screw with a 6-in. hand wheel, located in the center of the top block, provides means for clamping the work in position.

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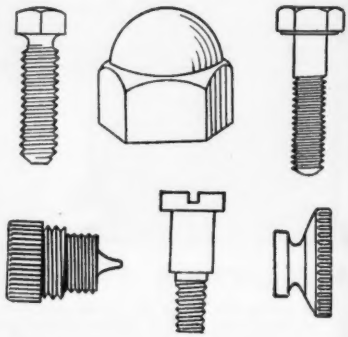

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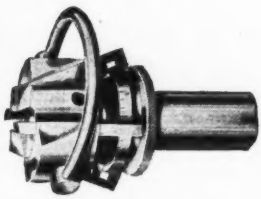

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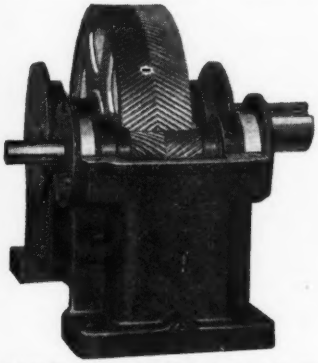

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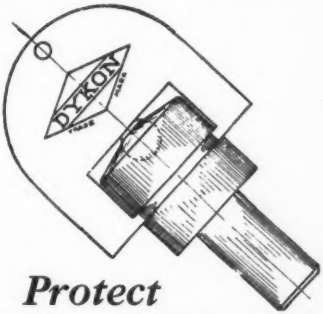

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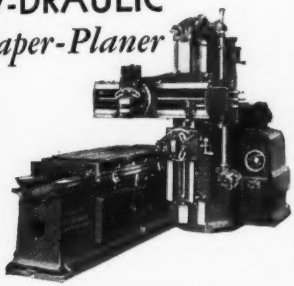

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Boring Tool With Micrometer Adjustment: A circular describing and illustrating the Palmgren Off-Set Boring Tool, which is adaptable for either tool or production work, can be had by addressing the Chicago Tool and Engineering Co., 84th St. and So. Chicago Ave., Chicago, Ill.

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Grinding the Centerless Way: The advantages of the centerless grinding method is discussed in a booklet which also describes the centerless grinding machines made by Cincinnati Grinders, Inc., Cincinnati, Ohio. The illustrations show various types of jobs in process, and full data is included. Copy free upon request.

Cincinnati Hydromatics With Locked Hydraulic Feed is the title of a book that describes in detail the new type of automatic milling machine with hydraulic feed which has been developed by The Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio. Copy free to any machine shop executive.

Handbook For Drillers: The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly.

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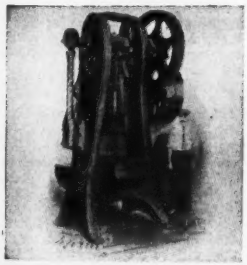

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Columbia Tool Steel Handbook: A book containing valuable information concerning the making of tools, heat treating, uses of hardness testing instruments, uses of the quenching bath, drawing bath, and other heat treating equipment, and together with tables and other useful information can be obtained without charge by addressing the Columbia Tool Steel Co., 550 E. 14th St., Chicago Heights, Ill.

Broaching for Profit: A combination round and spline broach which broaches the drilled hole to size, cuts the splines, and removes the burrs in one operation is described in a circular which will be sent free by The Connecticut Broach & Machine Co., New London, Conn.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Make Better Dies: Better work can be produced, and in less time, if the die can be held in the most convenient position. A universal die-holding stand which can be quickly adjusted to hold a die at any height or angle is described in a catalog which can be obtained by addressing Davenport Locomotive & Mfg. Corpn., Dept. M, Davenport, Iowa.

Davis Keyseaters: Recent developments in keyseating methods are discussed in a bulletin that also describes the keyseaters made by the Davis Keyseater Company, 250 Mill St., Rochester, N. Y. Copy free upon request.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Quantity Drilling: A semi-automatic multiple spindle drilling machine which is designed to produce the maximum of drilled holes in medium or small parts, is described in a pamphlet that is published by the Detroit Machine Tool Co., 5055 Woodward Ave., Detroit, Michigan. Sent free upon request.

Precision Grinding: A booklet which describes and illustrates the most modern methods of performing all kinds of precision grinding operations, showing how the Dumore grinder can be applied to various kinds of machine tools, has been published by The Dumore Company, Racine, Wis. Copy free upon request.

Interchangeable High Production Tools: Catalog No. 28, issued free by the Eclipse Counterbore Co., 7410 St. Aubin St., Detroit, Mich., describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

Precision Measuring Instruments: The latest types and models of dial indicators, thread lead test gages, pitch gages, thickness gages, dial comparators, and other precision measuring instruments marketed by the Federal Products Corporation, Providence, R. I., are described and illustrated in a book that will be sent free upon application to this firm.

Gear Tooth Shapes: A study of the fundamental principles of involute gearing and treatise on the development of the standard tooth form are contained in "Gear Tooth Shapes," published by The Fellows Gear Shaper Co., 78 River St., Springfield, Vt. Copy free upon request.

Questions To Ask Before Buying a Jig-Boring Machine: A list of the fine points to look for in a jig-boring machine, with descriptions and illustrations of the working parts of the Swiss Jig Borer, can be obtained free by addressing The R. Y. Ferner Co., 1511 K St., N. W., Washington, D. C.

Production of Metal Stampings: The Ferracute Machine Co., Bridgeton, N. J., is publishing a booklet which describes and illustrates the most modern equipment for the production of metal stampings. Copy free upon request.

Silent, Self-Lubricating Gears for use in all kinds of machines are described in a booklet that can be had upon application to Fibroc Insulation Company, Valparaiso, Indiana.

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Fosdick Drills: This publication gives details as to the design and construction of Fosdick Radial, Upright, and Sensitive Drills. Published by the Fosdick Machine Tool Co., Cincinnati, Ohio.

"Non-Clog" Coolant Pumps are described and illustrated in a booklet which has been issued by the Fulflo Specialties Co., Blanchester, Ohio. Copy free upon request.

Modern Grinding Equipment: The complete line of universal tool and cutter grinders, surface grinders, drill grinders, tap grinders, and other grinding machines made by the Gallmeyer & Livingston Co., 336 Straight St., S. W., Grand Rapids, Michigan, is described in a series of bulletins that have been issued by this firm. Free upon request.

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Swiss Files: The complete line of Grobet Swiss Files for use in die and tool work or for other fine work is described and illustrated in Catalog "K," published by the Grobet File Corporation of America, 3 Park Place, New York, N. Y. Copy free upon request.

Drilling and Grinding Electrically: Catalog M, showing and describing a variety of modern electric portable drills, grinders, and other tools, including floor grinders and buffers, has been issued by The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, Ohio.

Speed Reducers: A catalog of speed reducers up to 200 h.p. and built to deliver any ratio desired in standard size units can be obtained by addressing The Horsburgh & Scott Co., 5110 Hamilton Ave., Cleveland, Ohio. Give firm name.

"Houghton's Refrigerant Base" and "Hocut"—metal cutting oils manufactured by E. F. Houghton & Co., Philadelphia, Penna., are fully discussed, together with their outstanding properties, in two booklets which can be obtained without charge by addressing this firm.

Internal Grinding Equipment: The latest equipment for grinding holes of all sizes, from small wrist pin holes to the holes in locomotive cylinders, is described and illustrated in a booklet that will be sent free by the Hutto Engineering Co., Inc., 542 Lycaste Ave., Detroit, Michigan.

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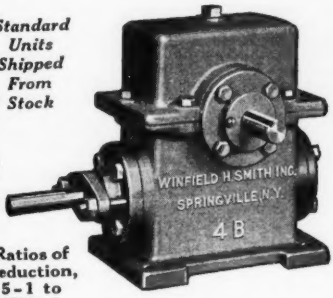

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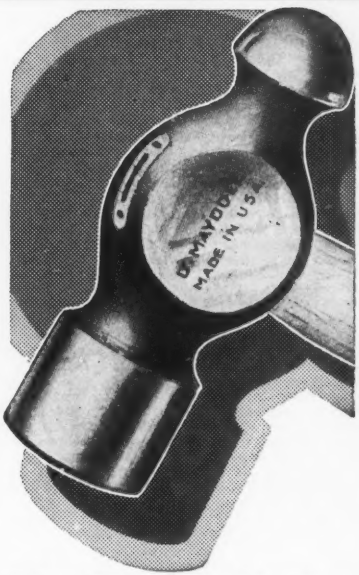

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Lathe Dogs and C Clamps are described and illustrated in Catalog No. 80, issued by the W. G. LeCount Tool Works, South Norwalk, Conn. Copy free upon request.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Punching and Shearing Operations: A complete line of machines for perforating and cutting metal in practically any size and shape is described and illustrated in a booklet which has been issued by The Long & Allstatter Co., Hamilton, Ohio. Copy free upon request.

Rapid-Reading Micrometer: A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

Finish Irregular Surfaces the Modern Way: Irregular surfaces in dies, patterns, tools and other parts where the use of a file is difficult and laborious can now be finished quickly and neatly by the use of the Kipp Air Grinder. Catalog and prices upon request. Address Madison-Kipp Corporation, 219 Waubesa St., Madison, Wis.

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Time Saving Machine Equipment: How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests, and other McCrosky equipment is told in a book that is issued by the McCrosky Tool Corporation, Meadville, Penna. Will be sent without charge.

Hi-Production Counterbores: A counterbore of simple yet highly efficient construction, with positive drive, rigidity, and a number of other features is described in a circular which will be sent free upon request. Address Morse Counterbore & Tool Co., 12281 Turner Ave., Detroit, Mich.

Automatic Tapping and Threading Tools of the latest types and designs are illustrated and described in Catalog No. 25, which has been issued by the Murchey Machine & Tool Co., 951 Porter St., Detroit, Mich. Copy free upon request.

Nateo Drilling, Tapping, and Boring Equipment is the title of a publication that has been issued by The National Automatic Tool Co., Richmond, Ind. The book gives details as to construction and uses of "Nateo" multiple drilling and tapping machines.

Milling Internal Keyways: A simple method of milling keyways in gears, wheel hubs, and other similar parts with the aid of a drill press and a special tool is explained in a booklet that is published by the National Machine Tool Co., 2271 Spring Grove Ave., Cincinnati, Ohio.

"40 Minutes or 4 Minutes" is the title of a folder which tells how templets, gages, and other irregular shapes can easily and quickly be cut from sheet metal by the use of the Handnib. Address National Machine Tool Co., 1542 Clark St., Racine, Wis.

"The Answer to Your Gear Problems": Information as to correct methods of cutting and finishing gears will be supplied without charge by The National Tool Co., Cleveland, Ohio. This firm also carries a complete stock of gear shaper cutters and markets the National-Cleveland Spur and Helical Gear Grinding Machine.

Save Time with Expanding Mandrels: How expanding mandrels will solve the problem of turning pieces with odd-size holes, and will increase production on duplicate work, is told in a folder that will be sent free upon request by W. H. Nicholson & Son, 136 Oregon St., Wilkes-Barre, Pa.

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How To Grind Cemented Tungsten Carbide: A booklet which describes and illustrates the correct methods of grinding tungsten carbide tools has been published by the Norton Company, Worcester, Mass. Copy free upon request.

Speed Reducers: Speed Reducers to obtain any desired reduction up to 24,000 to 1 are described and illustrated in Catalog 29-A, issued by The Ohio Gear Co., 1335 East 179th St., Cleveland, O. Copy free upon request.

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"Turning With Tungsten Carbide" is the name of a book that has been issued by The Porter-Cable Machine Co., 300 Wolf St., Syracuse, N. Y. This book answers the most important questions as to the uses of this new cutting alloy, and also describes a new lathe which has been developed especially for use with tungsten carbide tools. Copy free upon application.

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"Ready-Made" Die Sets: 28 styles and 200 sizes of Producto "Ready-Made" Die Sets are described in Catalog No. 5, which has been issued by The Producto Machine Co., Bridgeport, Conn. Ask for a copy.

Lift By Electricity: Ways to eliminate lifting, carrying and hand trucking by the use of the Reading "Everedy" single-drum, self-braking electric hoist are discussed in a booklet that can be obtained free from Reading Chain & Block Corp., Reading, Penna.

Fulmore Industrial Clutch: A multiple disc clutch, made in two types, to run in oil or dry, and which is so built that it can be operated at high speeds, is illustrated and described in a folder that will be sent free by the Rockford Drilling Machine Company, Rockford, Ill.

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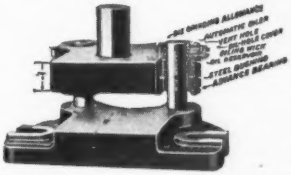

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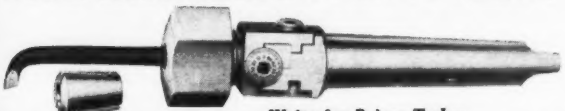

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Safety Grinding Wheels: The complete line of grinding wheels made by the Safety Grinding Wheel & Machine Co., Springfield, Ohio, is described in Catalog No. 11, which is issued by this firm. The book also contains instructions for operating grinding wheels, tables of grinding wheel speeds, pulley calculations, and other information for the user of grinding wheels.

Saving Time With Small Tools: A line of time-saving small tools, including "Use-'Em-Up" drill sleeve, "Wear-ever" chucks, collets, cutters, reamers and tap holders, counterbores, spotfacers, and other tools is described in Catalog 36, issued by Scully-Jones & Co., 1909 S. Rockwell St., Chicago, Ill.

Equipment For the Shop: Vises for the bench, drill press, milling machine or shaper; angle plates; adjustable clamps, jacks and other tools for the machine shop, are described and illustrated in a booklet that is published by the Sheldon Machine Co., 3253-55 Cottage Grove Ave., Chicago, Ill. Copy free upon request.

Rapid Drill Jigs: How time can be saved and drilling operations made easier by the use of a quick-acting drill jig is told in a booklet that is issued free by the Slewek Tool & Die Co., 10230 Woodward Ave., Detroit, Michigan.

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The Most Efficient Speed for the operation of special production units, power conveyors, and other machinery by the use of the WHS Speed Reducer and how it can be obtained is told in a bulletin that will be mailed free by Winfield H. Smith, Inc., 30 Eaton St., Springville, N. Y.

Shaping with Modern Equipment: The Smith & Mills Company, 2889-91 Spring Grove Avenue, Cincinnati, Ohio, has issued a booklet which describes and illustrates the line of modern shaping equipment made by this firm. Copy free upon request.

Accurate Gages Speed Production: The complete line of snap, plug, ring, pin, dial indicator, and special gages made by the Standard Gage Co., Inc., Poughkeepsie, N. Y., is described and illustrated in Catalog No. 4, which can be had without charge by addressing this firm. Johansson gage block sets and accessories are also listed in this book.

Machinists' Tools and Gages: Catalog No. 24, issued by the L. S. Starrett Co., Athol, Mass., describes and illustrates the complete assortment of machinists' fine tools and gages made by this firm. Copy free upon request.

Engineering and Manufacturing Service: A complete engineering and manufacturing service for manufacturers who are not equipped to handle all of their own designing, experimental, or production work is described, with illustrations of the equipment available, in a bulletin that is issued by The Steel Products Engineering Co., Springfield, Ohio.

Flexible Shaft Equipment: The uses of the flexible shaft for drilling, grinding, and other operations is discussed in a booklet which also describes and illustrates the flexible shaft equipment made by N. A. Strand & Co., 5001 N. Lincoln St., Chicago, Ill.

Cutting Oil Data: A series of booklets containing valuable information about cutting oils and their uses for thread-cutting, broaching, and general cutting purposes will be sent free to any mechanical executive by D. A. Stuart & Co., 2727 South Troy St., Chicago, Illinois.

Quality Drilling Machines: The high-grade drilling and tapping machines made by the Superior Machine Tool Co., P. O. Box 376, Kokomo, Ind., are described and illustrated in a booklet that will be sent free upon application to this firm.

Precision Measuring Instruments: The gages, micrometers, and other precision measuring instruments made by the Swedish Gage Co. of America, 7310 Woodward Ave., Detroit, Mich., are fully described in an interesting booklet that has been published by this firm. Copy free upon request.

Save Cutting Oil: How cutting oil can be separated from chips and thus reclaimed by the use of a centrifugal chip "wringer," is told in a bulletin that is issued free by the Tolhurst Machine Works, Troy, N. Y.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

A Simplified and Improved Drive Control for Machinery: Two distinct types of plate clutches that have proved successful highly in the driving mechanism of machine tools are described and illustrated in a bulletin that will be sent free by the Twin Disc Clutch Company, Racine, Wis.

Powerful, Easy-Acting Chain Hoists of the most modern design are described and illustrated in a booklet that is issued by the Union Manufacturing Co., 296 Church St., New Britain, Conn. Copy free upon request.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 24, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

Tool Chests for Machinists and Toolmakers: The complete line of fine tool chests for machinists and toolmakers made by J. M. Waterston, 420 Woodward Ave., Detroit, Mich., is described in Catalog No. 25. Ask for it.

"Wedge-Lock" Multiple Bit Tool Holder: A new type of tool holder, in which the tool bit is held by the action of a wedge, is described in a bulletin which will be sent free upon request by the Wedge-Lock Tool Co., 2521 N. Keeler Ave., Chicago, Ill.

Screw Machine Products: Full information as to the manufacturing service on screw machine products maintained by Western Screw Products Co., 19-31 St. George St., St. Louis, Mo., will be sent upon request.

Shop Furniture: A catalog describing and illustrating all kinds of shop furniture, including benches, vises, steel stands, foremen's desks, chip trucks, steel racks for bar stock, steel tote boxes, and other equipment will be sent free upon application to The Western Tool & Manufacturing Co., 1620 East Pleasant Street, Springfield, Ohio.

Drill Horizontally: The advantages of the "Whirlwind" Horizontal Drilling Machine for high speed drilling on small work are discussed in a bulletin which has been issued by Whirlwind Products Co., 1737 Ludlow St., Indianapolis, Ind. Copy free upon request.

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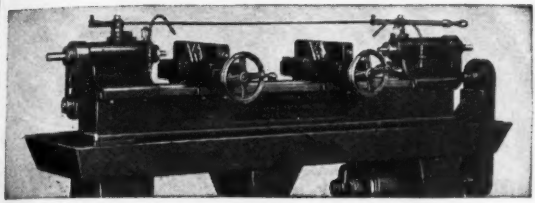

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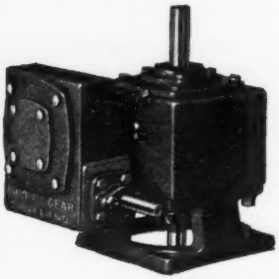

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THE SCRAP PILE

By GEO. ALEXANDER MANN

The ol' time one-armed driver now has a son who takes a taxi and uses both arms.

Tuff

In her last job,
But a day she tarried—
There was no future—
The boss was married.

The most undependable thing of today is tomorrow.

Oh—Clarence

"I've had an X-ray taken
Of my knee," said Myrtle Dunn;
"Oh," said Clarence Dumbell,
"Gosh, can I have one?"

They's jest one thing worse than bein' old and bent—and that is bein' young and broke.

Maw—in 1939

"Paw, I wish you'd speak to Willie. He's been flying back and forth across the Atlantic all afternoon."

Mame's working in a shirt mill;
She says her job's a wow.
She's off each day because, she says,
They're making nightshirts now.

Reach for a sweet and if you get her you're lucky.

Life Is Tuff

Of advances steno Liz
Sez there either isn't any,
Or else yuh find the boss
Makin' too dern many—

Answer Me That

It's all right to give a woman driver half the road, but how can yuh tell which half she wants?

Yeh—Mel—Nearly everybody who serves home brew brags 'bout how carefully it's been strained, when most of it looks as though it hadn't even been sifted.

Myrt says she don't like to dance 'cause it's jes' simply huggin' set to music an' she never did care for music.

Sad Music With This

Her eyes were black as night,
(Oh mother, call the hack)—
I kissed her and her husband came,
Now mine are twice as black.

Don't be too fast about makin' up to the guy with the magnetic personality—you may find that everything he buys is charged.

Tell the average man that he's a handsome brute and he'll deny most emphatically that he's a brute.